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A Call for Action

On the 15th of December a letter by Dr. C. E. Iredell appeared in *The Times*—a letter which, in a few well-chosen words, presented some vitally important facts concerning the present position of physical medicine.

Dr. Iredell pointed out the striking discrepancy between the large number of registered auxiliaries practising physiotherapy and the comparatively few registered medical practitioners actively interested in this form of healing.

He says "The extent to which this form of treatment has increased is shown by the fact that while in 1918 the society (C.S.M.M.G.) had 5,000 members, there are over 11,000 at the present time. It might, therefore, be thought that the number of doctors practising this speciality would have increased in like proportion. The facts point in the other direction. Within the last two years no suitable candidates applied for vacancies in the directorships of the physiotherapeutic departments in two of the most important hospitals in the kingdom, showing that the teaching hospitals cannot supply their own needs."

Surely this is a grave indictment of the apathy shown by the medical profession at large to physiotherapy. For the large and well-trained band of medical auxiliaries, who are competent to employ most forms of physiotherapy, we have nothing but praise. At the same time it seems a somewhat humiliating reflection that every physician should not at least have sufficient understanding of the subject to be able intelligently to depute these capable auxiliaries to carry out treatment under his recommendation and with his co-operation.

For such a state of affairs there must be some fundamental cause—not connected entirely with the apathy sometimes shown by the British medical profession to advances in medical knowledge. Again Dr. Iredell indicates this cause: "It might be thought that the British Post-Graduate Medical School, which gives instruction to graduates in most medical subjects would teach physiotherapy also and therefore be able to supply specialists in this subject. This institution, started recently under the ægis of the Ministry of Health, the London County Council, and the London University, gives no instruction in this particular speciality."

There is little doubt that the fault to a large extent lies in the lack of teaching facilities in physical medicine, both before and after qualification. Undoubtedly the medical curriculum is crowded, but this is hardly an excuse for the exclusion of a branch of medical knowledge which offers so much of proved value to therapeutics—and which, moreover, is recognized to the full by the medical communities of every other country of importance. Physical medicine should and must be included in the curriculum of every medical student.

With regard to post-graduate education, there is also room for extensive improvement. That such a fine institution as the British Post-Graduate Medical School has not yet seen fit to include teaching in physiotherapy is unfortunate, and should be remedied. A lead from it would undoubtedly have a beneficial effect in stimulating the interest of other centres where post-graduate teaching is carried out.

The decision of the Government to make provision for extended arrangements for the treatment of cancer and the fact that it expects to find difficulty in finding specialists

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A CRITICAL REVIEW OF THE THERAPEUTIC ACTION OF HIGH-FREQUENCY CURRENT

By W. J. TURRELL, M.D., D.M.R.E.

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Introduction

WHEN we consider that at the present time there is no systematic and organize teaching of electrotherapy, no examination in the subject in the medica curriculum, and no Society at which discussions upon it can take place, it i not surprising that so much confusion and such conflicting and contradictory opinion exist concerning such a new development of the high-frequency current as short-wav therapy. The sole redeeming feature at the present time is to be found in The *Britis Journal of Physical Medicine*, which has been so efficiently and ably carried on an which alone affords us a common ground for the expression of our own views and fo the consideration of the opinions of other workers.

This article is an attempt to elucidate some of the fundamental principles of th high-frequency currents in their application to therapy.

The younger generation of electrotherapists are entering the field of electrotherap in many cases without having had any previous training in the older methods o galvanism, faradism, or static electricity, and are plunged at once into the sphere o short-wave therapy without any previous experience of the early forms of high frequency currents, such as the high-frequency currents of tension (d'Arsonvalizatio or the high-frequency currents of quantity (diathermy). Hence has arisen th regrettable erroneous belief that short-wave therapy is an entirely new metho essentially different from the older forms of high-frequency currents. If we wish t gain a scientific knowledge of any subject, we must make ourselves acquainted with i in the proper manner by tracing its development from its fundamental principles.

The fundamental principle upon which the therapeutic application of high frequency currents is based, is the fact that they enable us to administer electric current of three or more amperes at very high voltage, not merely without any injurious effects but without even exciting any muscular contraction or any sensation beyond that o heat. Fifty years ago both the layman and the expert physicist would have laughe to scorn the idea that, by means of high-frequency currents, it would be possible t converse with our friends in America. A similar reception, Bordier tells us, wa accorded to d'Arsonval when he first attempted to bring his great discovery to th notice of the French Academy of Medicine. The Secretary-General of that Societ came to him in a state of great consternation and announced that he could not accep such a fantastic statement. "Look here, my dear d'Arsonval," he said, "this canno be serious! You assure us that the human body can be traversed with impunit by currents a thousand times more intense than those which can destroy us b lightning! Not only are they not productive of any evil effect, but we do not fee them. Can it be possible? And, then, what are these currents which change thei direction a million times a second? What is the instrument so delicate that it ca

measure a millionth of a second? Go away, repeat your experiments; I wish to spare you the disgrace of publication, lest you are discovered in an enormous error."

The Therapeutic Basis of High-Frequency Currents

If we wish to understand the therapeutic action of high-frequency currents, it is surely of primary importance to ascertain why these powerful currents have no excitatory effects. The first attempt at an explanation of this phenomenon was that of Claude Bernard who attributed it to "inhibition."

This term is applied "to any process by which an action in progress is stopped by the application of some influence from without." (Bayliss). This explanation does not carry us very far, for it is clear, as Bayliss points out, that inhibition cannot show itself unless the tissue is in a state of excitation from the cathode, when the anode is applied. Thus it cannot explain the absence of an initial shock from the application of a high-frequency current. A very simple, but not very illuminating reply, is usually given by the examination candidate in reply to the question: "Why do not high-frequency currents excite muscular contraction and give rise to no sensation beyond that of heat?" His answer generally is, "Because they are so fast."

Scarcely more helpful, though doubtless quite correct so far as it goes, is the explanation offered by the physicist that, owing to the rapid reversals of the current, the ions are drawn back before they have had time to become effective in either direction. We require more detailed and extended explanation than this to enable us to visualize the reason for the non-excitatory action of these currents.

F. Bugnard and A. V. Hill, in three papers on "The Effect of Frequency of Excitation on the Total Electric Response of Medullated Nerve," conclude that, "The failure of high-frequency alternating currents to stimulate an excitable tissue is primarily due, not to the frequency at all, but to the short duration of the half-wave." (This comes to much the same thing, for the higher the frequency the shorter is the half-wave). "These results cannot be explained if it be supposed that shocks which are ineffective, because they fall in the absolute, or relative, refractory phase are without effect. It is necessary to conclude that such shocks maintain and extend the refractory period."

Electrotherapists are unable to accept the refractory period as an explanation of the non-excitatory effects of high-frequency currents for two reasons. Firstly, it does not explain the non-excitatory effect of the first and sudden application of high-frequency currents. And, secondly, it does not explain the very powerful excitatory effect of a rectified high-frequency current, in which the current pulsates at high frequency in one direction only, from zero to maximum, and which should extend the refractory period equally, if not more than, the alternating high-frequency currents.

It should be remembered, however, that these physiologists were dealing with condenser discharges at a far lower voltage than that employed by electrotherapists; hence they did not require a higher frequency than 5,000 a second to annul excitation.

Before we can understand the non-excitatory effects of high-frequency currents, we must realize how the excitatory effects of electrical currents are produced and then consider how high-frequency currents annul these effects.

The process of electrical stimulation of the tissues is an electro-chemical one. When we establish an electrical current through the tissues the cations or hydrogen ions, owing to their higher relative velocity, concentrate at the negative pole, to which they are attracted, in excess of the anions or hydroxyl ions. A muscular contraction at the negative pole results. At the interruption of the current the muscular contraction invariably takes place at the anode. The mechanism by which this is occasioned is not so clear as is the case with the cathode.

Keith Lucas stated that "the one feature which is common to the cathode when the current is made, and to the anode when the current has just ceased to flow, is an increase of the concentration of cations above the value which occurred at each of these points immediately before."

But, as Bayliss points out in this connection, at the anode the concentration of cations only rises to its normal by diffusion, after having been decreased. Consequently, at the break of the current there is a momentary decrease in cations, and hence a relative excess of anions. Thus we may regard the action of the cathode at make as due to a concentration of cations, and the contraction at break as due to a momentary excess of anions. We may then visualize the process as an electro-chemical one by which the complicated colloidal structure of the cell membranes are so effected as to result in sensation and muscular contraction. The further steps in this complicated bio-chemical process are beyond the scope and realm of the electrotherapist.

It has been demonstrated that a measurable, but very brief, period elapses after the application of an electrical stimulus before it can take effect. If the current is reversed by high-frequency alternation before this period has elapsed, the hydrogen ion concentration at make will be annulled by the hydroxyl excess at break before either has time to become effective. Such a view serves to explain why strong excitation occurs when high-frequency currents are rectified and why no initial shock occurs on the sudden application of high-frequency currents, and all the other phenomena observed in relation to excitation in the clinical administration of high-frequency currents. If the implication of such a theory had been earlier recognized, physiologists should have been able to predict, before the discoveries of Hertz, that, provided the frequency of alternation was sufficiently high, no excitation would result from high-frequency alternating currents.

It is not, I think, generally recognized that Joubert, of Paris, was the first to demonstrate the non-excitatory action of high-frequency currents, when, in 1889, repeating the experiments of Swammerdam and Galvani on the frog's leg, by utilizing an apparatus of Hertz, which provided alternations up to 100,000,000 (!) a second, he failed to excite contraction in the neuro-muscular preparation. (Bordier).

Diathermy is not "A Pure Current of Conduction"

One of the most misleading statements made in connection with high-frequency currents is to the effect that diathermy is "a pure current of conduction," and for this reason is sharply defined from short-wave currents which are currents of capacity. Such a statement is calculated to lead to a very false conception of the nature of high-frequency currents. It is an absolutely false distinction for two reasons. Firstly, as in the whole range of electromagnetic vibrations, it is impossible to state where the effect of one merges into the action of its adjoining wave-length, for we can no more state at what wave-length the short wave commences and the wave-length of diathermy ceases than we can definitely decide a point in the visible spectrum at which the violet ceases and the indigo begins. Hence, it follows that short-wave therapy is not an entirely new and distinct entity, but is merely a development of the high-frequency current, possessing marked features of its own, which gradually develop as the wave-length shortens and the frequency correspondingly increases. Secondly, it is evidently misleading to state that the diathermy current is purely one of conduction. It is difficult to understand how such an error can have arisen when it is remembered that high-frequency currents, when first applied to therapy, were administered as currents of capacity, namely, the wire cage of d'Arsonval and the condenser couch. The former of these differs little, if at all, in principle from the modern application of the "Inductotherm," and the latter is still largely utilized for the application of diathermy.

One of the best methods of applying diathermy in the treatment of generalized rheumatism, associated with hypothermia, is to seat the patient on a condenser chair with a soaped metal-electrode (10 x 2 inches) across the shoulders and to apply a current of from 0.9 to 1 ampere for about 30 minutes. The temperature, which, before the treatment, may have been only 97° F, will be found to have risen to about 99° F or slightly more at the conclusion of the treatment. If, during the course of this treatment, a neon tube be applied to the head, toes, or any part of the patient's body, it will be brilliantly lit up by the leakage from the patient's capacity charge. It is apparent, therefore, that we are not entitled to say that diathermy is a "pure current of conduction," neither are we justified in stating that short-wave currents are solely, though they are predominantly, capacity effects. It is possible, when administering short-wave therapy, to employ bare metal-electrodes in direct contact with the skin, in place of condenser electrodes, but by so doing we greatly increase the danger of burns because of "the comparatively high voltage of the short-wave patient's circuit." (Schall.)

What we are entitled to say is that as the wave-length shortens the current of conduction is replaced more and more by the current of capacity.* A correct appreciation of this fact will enable us to select the most suitable wave-length for the case under treatment. Short-wave therapy has by no means entirely displaced diathermy; there are many cases, such as the one outlined above, that can be better treated by the latter than the former.

The Terms, "Selective and Specific Action"

The variation that takes place in the transmission of high-frequency currents as the wave-length varies has led to the introduction of such terms as "selectivity" or "selective action" and "specificity" or "specific action" in relation to the action of these currents. These terms have for some time past been employed in regard to the action of X-rays on the nuclei and their chromosomes; but neither in the case of X-rays nor of ultra-violet rays is there a selective action on the part of these agents, that is, a choice in preference to others, amounting almost to volition. The effect is due to a varying radiosensibility on the part of the tissues acted upon. The chromosomes are the first part to arrest the energy of both X-rays and ultra-violet rays, and are consequently the first part to be acted upon by these agents. In the same manner it is the nature of the structures to which high-frequency currents are applied that determines the action of these agents.

Neither have the high-frequency currents a specific action, either in the sense of "the property of removing directly, one disease rather than any other," or of "something certain to effect the purpose for which it is used; i.e., an unfailing agent." The loose application of such terms is calculated to cause much confusion in our ideas and to create much misapprehension.

Owing to the fact that, as the wave-length varies, the path of the current is materially affected, its action will also be correspondingly altered. For practical purposes we may visualize the transmission of high-frequency currents by conduction in a medium of high conductivity, but in the absence of a conductive path, provided that the voltage is sufficiently high, they will find a path by capacity or displacement effects, and such a passage will be much facilitated by a shortening of the wave-length.

The human body is of such complex constitution that any analogy from laboratory experiments conducted in such highly conducting media as blood or serum is both

*As a symbolic explanation of this phenomenon, I would suggest that, with the longer wave-lengths, the high-frequency current by-passes the smaller particles by a conductive path; but, as the wave-length shortens and the frequency increases, the current takes a short cut through the more minute particles by means of its capacitative action.

useless and misleading when attempting to elucidate the action of these currents within the human body. We have consequently to be on our guard against accepting as conclusive many of the experiments performed in physical laboratories.

Bordier has, I think, hit upon the most happy phrase to describe the path of these currents in the human body: namely, a leaky condenser action. Thus we may conclude that the human body is composed in part of a highly conducting medium, but, in its more minute and intimate structures, of condensers of a varying leaking character. From this we may deduce the conclusion that the body components will be affected in a different manner by variations in the wave-length of the high-frequency currents, namely, with the longer wave-lengths the more highly conductive media will play a major part, but, as the wave-length shortens, the leaky condenser action of the more minute components become more in evidence, and the effect of the treatment will be thereby varied.

When I first read the early literature on short-wave therapy, I was much struck by the remarkable results that were obtained in those parts of the tissues where a capacitative action could be visualized. My early experience of the practical application of short waves commenced in January, 1934, and my subsequent observations have fully confirmed these early impressions. For it is in such conditions and regions as the following that we see the most striking results from short-wave therapy; in cerebral conditions, where we have the capacitative action of the badly-conducting bony skull and the capacitative action of the brain cells; the capacitative action of the bony thorax and the capacitative action of the innumerable air sacs of the lungs; the capacitative action of bones and joints, which yields such good results in the treatment of periostitis and osteomyelitis and in the treatment of carbuncles and encapsuled boils and abscesses. Whereas, in the highly conductive tissues of the abdomen, its benefits are not so marked; except perhaps in the case of cholecystitis, where a capacitative effect of the tissues involved might occur. In appendicitis, and in diffuse suppurative conditions, such as Ludwig's angina, it tends to cause extension of the lesion and its use is consequently contra-indicated. Such a view of the nature of short-wave therapy affords both a guide to the cases in which it should be applied and to those in which it should be avoided.

The Deep Heating Effects of High-Frequency Currents

According to the views expressed by many writers on electrotherapy one of the most remarkable changes occasioned by the introduction of short-wave therapy is the abandonment of the theory of the deep heating effects of the diathermy currents—an action which their very name implies. For we are now assured that, if we wish to obtain deep heating effects, we must substitute the short wave for the diathermy currents.

Now, what are the facts? The diathermy current being mainly a current of conduction must have a heating effect throughout its whole path. In its passage through a constricted area, the heat generated will necessarily be greater at the point of constriction, for there its density will be greatest. If one electrode be smaller than the other, the density of the current, and consequently the heat produced, will be greatest at the smaller electrode. But in either case a deep heating effect must occur throughout the inter-polar path. If, however, the diathermy current is applied transversely to the flow of blood through a vascular region, the tissues will be cooled by the heat carried away by the blood, in an analogous manner to that by which the heat, generated by the explosions within the cylinders of a motor car, is carried away by the circulation of the water cooling system. Thus, if the current is applied transversely through the abdomen, a thermometer placed within an internal organ may fail to show any marked rise of temperature.

These points are better understood if we adhere to the old terms "longitudinal"

and "transverse," instead of adopting the more modern ones "in series" and "in parallel." The simpler terms are certainly better and convey their meaning more clearly.

When we envelop the body within the coils of the "Inductotherm," we occlude the loss of heat by conduction, convection and radiation and consequently a greater heating effect is obtained.

It is possible, and indeed probable, that, since in the application of short-waves the heating effect is developed more intimately within the cell membrane (the Dessaur Hot-Point theory), the cooling effect of the blood stream may be lessened and a deeper and, to some extent, greater heat might be developed. But the evidence of burns which, apart from hyperpyrexia therapy, so far I know invariably occur near the surface seems to negative any intense deep-heating effect from short waves.

Diagrams based on purely physical theory are apt to be misleading when applied to the human body, the complex structure of which and its reaction to different wave-lengths are at present so little understood.

We may, however, state that if the electrodes are smaller than the part to which they are applied, a form of treatment to which I have bestowed the name "parathermy," their action will be diffused over the body and the maximum effect will be near the surface. But, if the electrodes are larger than the part to which they are applied, the electromagnetic lines of force will tend to concentrate on the deeper structures; this would apply more to hyperpyrexia treatment, a method not free from danger, than to the methods usually adopted in short-wave therapy.

The "Athermal" Action of High-Frequency Currents

By far the keenest and most acrimonious discussion in relation to the action of short waves has arisen on the question whether their application results solely in the development of heat, or whether it has what has been vaguely termed an "extra-thermal action," or "extra-thermal effect," or an "athermic action or effect." But why employ such vague and non-committal terms? Surely, if the action of short waves is neither a thermal nor an electro-chemical one, it must be a dynamic or mechanical one; for the only three forms in which electricity is available for electrotherapy or anything else, is by its dynamic, chemical, or thermal action. It is generally recognized that high-frequency currents have no electro-chemical effects; if, therefore, there are effects which are not due to thermal action, by the process of exclusion they must be due to the dynamic action of the atomic and molecular vibratory energy excited by these currents, an action which precedes and generates the heat. How can we conceive that it is possible that the vibratory energy of incalculable millions of atoms and molecules can be raised within the human body at a rate of oscillation of 1,000,000 per second in the case of diathermy, or 100,000,000 in short-wave therapy, applied at a very high voltage, with no other effect on the delicately balanced system of the human body, and on the nervous system in particular, than that of the heat generated by these oscillations?

One of the most remarkable features of this controversy is that those who claim for these currents a purely heating effect entirely neglect to distinguish between the effects of heat applied to the body from an external source by radiation, conduction, or convection and the effects produced within the body by the arrest of the kinetic energy of the current and its transformation into heat energy within the tissues.

Nevertheless, in such a distinction the key to the problem may be found, for the physical effects of the two procedures must be very different. If we admit the validity of such a distinction, we must recognize that, when applying high-frequency currents, it is the impact and collision of millions of atoms and molecules, oscillating several million times a second within the tissues, that precede and generate the heat.

One of the chief difficulties of modern science is the appreciation of the action of such inconceivably minute particles as atoms and molecules, and, accordingly it is frequently stated that it is absured to attribute a dynamic or mechanical action to the vibration of such minute bodies. But, when millions of such particles are set in vibration by high voltage at a million times a second, mechanical effects will be produced which will vary with the density and voltage of the applied energy.

Apart from the heat generated, what would be the effects that we should expect to find from the arrest and transformation of this kinetic energy? If the density and voltage were sufficiently high, I submit that we should anticipate a disruptive action on the tissue cells; with a more diffused action, we should look for a dispersive action facilitating the dispersal of recent exudates. In order to explain more fully and in a less ambiguous manner the physiological processes by which the dispersal of effusions is brought about, we should have to study the effect of high-frequency currents on the Brownian movement of the colloidal particles, on adsorption and absorption, on the permeability of membranes, and on other abstruse physiological problems, many of which are not yet fully understood. Such a study is clearly beyond the scope of this article, but it should afford a most fruitful field for physiological and biological investigation.

The cutting-arc, perhaps, affords the clearest evidence of the disruptive action of high-frequency currents. How can we explain the cleaving action of this application, with so little coagulation and necrosis of the tissues that primary union occurs, in any other manner than by the disruption of tissue cells and the sealing action of the heat thereby generated on the neighbouring minute capillaries?

The histological evidence of the tissues cloven by the cutting-arc is of great significance and is described by Ellis as follows: "The histological effect on tissues can be described in zones, the innermost being a zone of mechanical disruption of tissue and explosion of cells. The question whether this effect is produced by molecular dissonation, due to the assumption by the molecules or atoms of the tissues of a new rate of vibration, causing dissolution of the molecular structure, as postulated by Oudin, or whether, as Jellinek thought, it is merely a thermal effect due to the sudden expansion of the cell when its liquid contents are converted to steam is speculative."

It is rather surprising to find Jellinek, the leading protagonist of the primary mechanical effect of high-voltage electricity and to whose valuable and extensive research on electro-pathology we are so much indebted, advocating in this connection a heating rather than a dynamic action. Moreover, it would seem that the heat dissipated in steam would not be available for the sealing action on the small capillaries and so the haemostatic effect of the application would be lost, also the time occupied in such a process would not be in accordance with the immediate effect that occurs in the operation, and hence would not offer such a satisfactory explanation as the instantaneous effect accompanying mechanical disruption of the cells.

When applying surgical diathermy by my method of "indirect diathermy" ("diathermie sans fils," D.S.F.), that is, with the patient seated on a condenser chair connected with one terminal of the apparatus, and the operator seated on a similar chair connected with the other terminal, the primus pricker applied to a thick wart cannot only be felt to vibrate, but can actually be seen to do so. Doubtless this vibration is occasioned by minute sparks produced by dissonation of the patient's and operator's capacity charge.

Some observers have remarked that blood is extravasated after treatment by a wave-length of 10, or less, metres. In one case, after a 6-metre treatment, I noticed

two red linear lines on an elderly patient's shoulder. There were no signs of a burn, ulcer, blister, or breach of skin continuity, the marks subsequently exhibited the colour changes of a bruise, and were in due course absorbed without leaving any mark or scar. The patient was not aware of these marks and complained of no undue heat during the treatment. Dr. Makar, of the Coptic Hospital, Cairo, has reported to me similar lines on the face of a child after short-wave treatment; though at first these marks much disturbed the child's parents, they subsequently cleared up without any disfiguration.

Apart from the generation of heat and the relief of pain consequent upon the application of high-frequency currents, the most noticeable feature is the remarkable disappearance of swelling and exudates, and, as Dr. Justina Wilson observes, "The absorption of haematoma is a very striking phenomenon."

Something more than heat is required to explain these phenomena, and it is to the dynamic effects of these currents that we must look for the explanation.

Not only are the results that we obtain from high-frequency currents not solely due to heat, but in some cases they are diametrically opposed to those produced by heat. Thus, if we apply a strong high-frequency current, even without the development of much heat, to a recent and acute case of brachial neuritis, the pain will often be much accentuated; but, if we apply any form of radiant or conductive heat to such a case, the pain will often be much relieved. Nerves may be regarded as "cylindrical condensers" and are consequently prone to the influence of high-frequency currents. It is not to be wondered at, therefore, that a nerve in a state of painful excitation may be adversely affected by the impact of powerful high-frequency oscillations apart from any thermal effect of such currents. But, though a nerve in a state of painful excitation may be adversely affected by a powerful short-wave current, it does not necessarily follow that it will not be relieved appreciably by the application of an exceedingly weak current: and this may be the explanation of the surprisingly favourable results that we so often obtain from the low-intensity therapy (L.I.T.) of Weissenberg.

The "Low Intensity Therapy" of Weissenberg

I must confess that at first I was somewhat incredulous of the remarkable results claimed for L.I.T.; but an extended experience of its employment in the wards, and in the electrical department of a hospital and in private practice has convinced me of its great efficiency in the relief of pain, and in the treatment of pulmonary and other diseased conditions.

I have witnessed it give speedy and great relief in allaying most agonizing sciatic pain following manipulation of the sacro-iliac articulation. Before the application of L.I.T., the patient could not be moved from the couch, upon which he was lying, owing to the severity of the pain. After 15 minutes of treatment by L.I.T. he was able to walk out of the hospital, and, as he expressed it, "he was eased no end" by the treatment.

In cases where ordinary short-wave therapy exacerbated the pain, I have found L.I.T. give marked relief. In a case of severe intercostal herpes, L.I.T. proved most beneficial after ordinary short-wave applications had failed to give any relief. Since no appreciable heat is developed or experienced, the benefits from the treatment would appear to be due to the direct effects from the impact of the oscillating atoms and molecules rather than to any thermal action. But, as Bordier points out, "The absence of a measurable thermic effect does not imply that no calorific action, though a weak one, intervenes to determine the modifications which are observed."

This illustrates the difficulty of our task in eliminating a thermal action from any application of high-frequency currents, however weak, and we must consequently rely

on the positive evidence of a dynamic action, rather than on the negative evidence of an inappreciable thermal effect.

In a long-standing case of recurrent abscesses of the lung, to which L.I.T. was administered, a more powerful apparatus not being at first available, the temperature, which had been of a hectic type for four months, became normal. Subsequently a more powerful current from the "Ultratherm" was applied, and two hours after the first three treatments by this current the temperature rose on each occasion to 102°F, then fell and remained normal. The patient ultimately made a good recovery, though the treatment did not prevent the recurrence of fresh abscesses. The temporary rise of temperature may have been due to increased absorption of septic products, the direct result of the oscillating impacts.

A case of very troublesome giddiness associated with migraine but unassociated with any detectable ear trouble, occurring in a young girl, reacted most favourably to L.I.T. though it had not improved under any other previous treatment. Before the treatment, attacks of giddiness occurred on stooping, playing tennis, and attending any place of entertainment. Twelve treatments by L.I.T. of from 10 to 15 minutes' duration were administered. The patient quickly began to improve and, at the conclusion of the course, was able to attend the Motor Show without any sensation of giddiness beyond a slight tendency to bear to the left.

A few months later she wrote, " After some weeks, I now think that I have given myself a very good test and I am sure that you will be very pleased to hear that the electrical treatment has made me very much better. The giddiness which I complained of only occurs very occasionally and that is when I get very tired." Fifteen months later the patient wrote: "I am glad to say that the giddiness for which you treated me is much better, though I have never completely lost it; I find more of it when I have either to walk or stand for a long time. The head pains which I complained of have entirely gone. I am sure this treatment did me a great deal of good for which I sincerely thank you."

Certain persons with a very highly developed tactile sense are able to detect a sensation of vibration when introduced to an oscillating field of short-waves. (Bordier.) H. Copin relates that homing pigeons released near the antennae of a wireless-transmitting station near Valencia, in Spain, entirely lost their orientation and flew aimlessly around while the station was working, but regained their sense of direction and flew away when the station ceased to function (Bordier).

Two cases of sterilization in men, who had been engaged in operating powerful wireless-transmitting valves, have been mentioned to me, but I have been unable to obtain any details of these cases. If these occurrences were substantiated, they would suggest a sensibility of the chromosomes to short waves analogous to their radio-sensibility to X-rays. If such vibratory effects occur from the radiation emitted by external agents, generating the oscillations, how much greater must be the effect on the tissues when these powerful high-frequency oscillations are generated within the body. As John Wesley observed, " How must these also confound those poor half thinkers who will believe nothing but what they can comprehend."

Conclusion

These observations, collected from several sources and based on extended personal experience, certainly warrant further research on the primary dynamic action of high-frequency currents. The assumption, so commonly held, that the action of high-frequency currents is merely that of heat, cannot lead to any appreciable therapeutic advance for deep heating can be secured by the prolonged application of conductive heat or infra-red radiation. With the old-fashioned roasting jack, by means of which

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Colonic Therapy in the Treatment of Chronic Intestinal Toxæmia

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In presenting a subject such as colonic therapy concerning which there is so much confusion and misconception, I shall attempt first of all to clarify issues and objectives. Following this I shall endeavour to formulate the principles upon which the rationale of this therapy rests. And finally, I shall discuss briefly the technique of treatment and management of cases.

Chronic intestinal toxæmia, although still denied by some, is nevertheless recognized as a definite clinical syndrome by a large and rapidly growing group of physicians. Without going too deeply into a discussion of the arguments *pro* and *con*, let us frankly admit that this syndrome is incapable of diagnosis either through the isolation of specific intestinal toxins, or by any one or more pathognomonic signs or symptoms, or yet by X-ray or other physical or laboratory test. Indeed, the condition cannot be said to conform to any definite disease pattern by which it might be infallibly recognized. To make a diagnosis one must first suspect its existence and then prove or disprove it. If it is present there will be little difficulty in confirming the findings to be of intestinal origin. Among other things we may look for anæmia, abnormal blood pressure, increased blood sedimentation rate, increase of the conjugated end-products of intestinal putrefaction in the urine, loss of weight, catarrhal conditions of the mucous membranes, foul breath, coated tongue, skin changes, etc. Singly, or in twos and threes, these findings may have slight significance, but, linked with subjective symptoms, the history of the case, etc., the presumption that our suspicions are correct will increase as the evidence multiplies. Improvement under therapeutic test will furnish the final proof.

Etiology of Intestinal Toxæmia

To gain a clearer conception of the wide range of disorders embraced by this syndrome and the variability in the manner of their expression, let us briefly consider the etiology and development of toxæmia by tracing the course of infection through natural channels. The etiological factor in all cases is a low-grade, non-specific chronic infection of either autogenous or exogenous origin. For example, let us take a focus in the teeth or tonsils. In this instance drainage occurs through the lymphatics to the right subclavian vein. The heart and lungs receive this blood. Beyond the heart are the capillary beds of all the organs and tissues of the body. Theoretically any of these may now become the seat of secondary foci.

We must remember, however, that dilution in the blood stream must be very great, and that the liver receives and purifies the blood in large amounts. Whether secondary foci originate directly from the primary focus or are the result of infection by organisms that have withstood the bactericidal action of the liver after this function has been injured, is an open question. In any event the liver is always involved in chronic focal infection and for that reason must be considered as a secondary focus itself. In

the presence of the primary or other secondary foci it now becomes the crucial link in a vicious circle.

With the function of the liver impaired it is not long before the biliary system becomes involved. The bile then carries infection into the bowel, adding new strains to the fæcal flora. Long before this, however, there are indications of colon stasis due to the depressing effects of circulating toxins upon the transport mechanism of the colon. The indigenous flora of the colon becomes altered under these circumstances, with the result that certain strains assume a pathogenic rôle without the necessary addition of any new strains from above or below.

However, with the addition of new strains from the biliary system the cæcum and colon become foci of major importance. Toxins and bacteria now entering the portal circulation from the colon add tremendously to the burden already on the liver, enhancing thereby the pollution not only of the general circulation but of the biliary system as well. Thus, a second circle is completed. The lymphatic drainage from the ileum and colon to the receptaculum chyli, thence to the left subclavian vein, becomes a third. And as the liver becomes damaged and congested with resultant stasis and hypertension of the portal circulation, we have a fourth by way of the hæmorrhoidal anastomosis to the internal iliac veins and inferior vena cava.

It must be evident now that, no matter how or where a chronic low-grade infection originates, the whole body ultimately becomes involved. It must also be evident that the colon, portal circulation, liver and biliary system form the circle of major importance. Whether or not we now remove primary foci in the teeth or tonsils or elsewhere, this circle is not influenced, but continues to exist as a constant source of toxic substances. With general breakdown of the first and second lines of defence (the colon, mucous membrane and liver respectively) the particular form and expression taken by this syndrome will depend upon individual susceptibilities of tissues and organs, and variations in the third line of defence, which embraces the immunity mechanism of the body, detoxication, and elimination.

Clinical Manifestations of Intestinal Toxæmia

Therefore, the following clinical entities, in so far as they may be traced to chronic intestinal toxæmia, or to chronic focal infection after the development of vicious circles, must be considered manifestations of this syndrome: arteriosclerosis, secondary anæmia, arthritis, cirrhosis of the liver, pyelitis, chronic sinus infection, chronic interstitial nephritis, myocarditis, asthma, various forms of colitis, sciatica, neuritis, myofascitis, hæmorrhoids, cryptitis, certain skin diseases, some nervous disorders, many endocrine disturbances, and much mental illness. Furthermore, causes predisposing to toxæmia may complicate and modify clinical expressions of this syndrome to the extent that a complete diagnosis may be difficult until the toxæmia has been somewhat relieved. Such predisposing causes may be disturbances of the autonomic nervous system, of central, endocrine or psychic origin, bacterial or food allergy, vitamin deficiency, active foci of infection outside the intestinal tract, or mechanical defects.

Various Methods of Treating Intestinal Toxæmia

That the usual methods of treatment of this condition are far from satisfactory is apparent both from the variety of opinions regarding the cause of symptoms, from the many angles from which it has been approached, from the vast array of methods and means of treatment that have been attempted and ultimately found wanting, and from the fact that no system has yet been devised sufficiently inclusive in its scope and

compelling in its results as to be universally acceptable as a working basis. The only comprehensive attempt to deal with this syndrome, biologically, has been undertaken by Bassler. Over a period of years he has succeeded in isolating 181 varieties of bacteria from diseased colons. He has studied their associations, symbioses, antagonisms, prevalence, pathogenicity, etc. He combats pathogenic strains by means of vaccines (subcutaneously and intracolonically administered), diet, antagonisms, colon irrigations and occasionally non-specific vaccine therapy. He claims cures in approximately 90% of cases. Yet of his method he says: "Unless all the work is done by one person and not entered into practically until several years of experience have been acquired I strongly recommend that it be not engaged in at all."

Lane attempted to rid the body of intestinal toxæmia by surgical removal of its origin—the caecum, appendix, and terminal ileum. Kellog's method of overcoming stasis is to feed roughage and bulk, for the purpose of inducing several bowel movements daily. Rowe has investigated the field from the point of view of food allergy; Larson, Morris, Dorst, Wherry, and others, from that of bacterial allergy. Metchnikoff, Moro, Tissier, Rettger, Cheplin, and others have advocated the use of cultures of the so-called "friendly" bacteria, either by mouth or by colonic implantation. The use of yeast has also had its advocates. Others have advocated non-surgical biliary drainage for the purpose of breaking the colon-liver vicious circle. Intestinal antiseptics by mouth and various types of cathartics have been tried. Agar, mineral oil, kaolin, sodium ricinoleate and many similar preparations have been used singly and in combination in attempts to change the intestinal flora. Yet none of these methods of treatment has proved entirely satisfactory.

Since our objective is the cure of chronic systemic toxæmia and clinical entities secondary to that, and since we have traced the development of this syndrome as influenced by predisposing causes, foci of infection, drainage routes and the establishment of vicious circles, the most logical method of treatment would appear to be one based on the knowledge and control of these factors. The principle underlying such a method would be that infection of tissues tends to disappear when drainage is free and in the absence of a feeder.

Colonic Therapy

Colonic therapy in the meaning of this paper, then, will be understood to include any and all measures of treatment for the accomplishment of our objective. This system of therapy and the principles upon which it is based will be found broad enough to meet the requirements of all disorders embraced by this syndrome. In the present discussion I will not go into predisposing causes or such auxiliary measures as diet, the use of vaccines, physiotherapy, etc., but will limit my remarks solely to the use of colon irrigations and instillations. These are used not only for the purpose of emptying the colon of old and infected accumulations, but also to encourage local and systemic drainage, to promote the healing of inflamed and injured tissues, to restore normal mechanical and cellular function, to improve lymphatic and capillary circulation, to relieve the liver of its increased toxic load, and to break the colon-liver vicious circle.

This regime, being essentially therapeutic, should be conducted by the physician himself or under his direct supervision. Although there are many varieties of apparatus and just as many techniques, the prospective purchaser of such apparatus need not be unduly concerned about his choice, for with but slight modification most any modern equipment will lend itself to any desired technique. In general, any method of irrigating the colon, to be acceptable, must satisfy certain conditions. In the hands of an average technician using ordinary care it should be reasonably foolproof against accident or injury to the patient. Solutions should be introduced slowly

and never under a gravity pressure greater than two and a half feet elevation, and never in quantities sufficient to overdistend the bowel. The temperature of the solutions should be accurately known at all times, so that the bounds of physiological tolerance may never be exceeded. The duration of treatments should rarely exceed thirty minutes. The method should ensure filling and final emptying of the caecum. The total amount of solution used at any one treatment should rarely exceed three gallons. There should be a minimum of manipulation, either external or internal. Actual massage or kneading of the abdomen should never be practiced. The patient should be relaxed at all times.

There are but two basic principles controversially involved in the discussion of technique. The first is that the colon should empty or be emptied from above downward; and the second, that it should empty or be emptied from below upward. Since the object of irrigation is to empty and lavage the entire colon, we must take into account, not only the physiological process of normal dæfecation which involves the distal colon, but the less frequently observed mechanism of complete evacuation as well. During the operation of this latter mechanism, all parts of the colon are active simultaneously for short periods of time with intervals of rest over a period of approximately fifteen minutes. This mechanism may be artificially activated by colon irrigation and prolonged by repeated stimulation as long as desired. Whether or not the impulse to expel should be initiated in the rectum and by repeated stimulation convey the impulse finally as far as the caecum, or whether the lower reflexes should be encouraged to remain quiescent till a tube or the irrigating solution reaches the caecum, and then aroused, may be said to be the point at issue. In either event the rectum and pelvic colon should be empty before the irrigation is begun. Either principle may be considered physiological—the choice in any given case depending upon one's knowledge of the individual patient and his colon, and what he desires to accomplish.

Technique of Treatment by Colonic Irrigation

In addition to the technique of an irrigation we must also consider the technique of the series, for the quality of our results will depend as much on one as upon the other. Without in any degree attempting to describe my own technique, which varies almost with every patient and therefore defies description, I will touch the high spots only of my usual routine in order to bring out a few points which I consider important.

I use a large jar filled with tap water at body temperature and a smaller one filled with a quart of medicated solution at a temperature to suit my purpose, varying from 40° to 50° C. These, separately controlled, are led to a common inflow tube carrying a No. 28 or 32 F. colon tube, long enough to reach to the splenic flexure. The water in the large jar is used for irrigating the colon and for advancing the tube; that in the small jar for instillation. Depending upon the nature of the case, I advance the tube well into the descending colon, drain off all excess solution, and immediately introduce a quart of medicated solution; or I irrigate with the tip of the tube in the rectum until I am satisfied that I have filled and emptied the caecum at least once, then waiting till activity has somewhat subsided, I introduce the medicated solution. Should a contraction occur during instillation of the medicated solution, the flow is stopped momentarily till relaxation occurs. One or two contractions may occur when introduction is low. However, following such contraction there is usually a period of relaxation sufficiently long to permit the solution to reach the proximal colon and caecum. This technique may be accomplished by any of the units equipped with a colon tube or colon tube and speculum.

All cases are treated daily for the first week, if possible, in order to empty and cleanse thoroughly the entire tract. If this cannot be arranged, not less than five treatments should be planned over a period of seven days. Failing this, treatments should not be started until such arrangements can be made. The reason for this is that during the period of cleansing and emptying the colon the greatest value is the cumulative effect of frequently repeated treatments. The colon is stimulated to unusual activity at the time of each irrigation, and the effect of the medicated instillation is continued for some hours beyond this time. The colon is not permitted to load up between treatments, and the process of softening and loosening mucus, old residues and interlining adhesions goes on uninterrupted. Were advantage not taken of these facts, not only would the value of the preceding treatment be partly lost, but the patient would tend to become more toxic. Furthermore, control over the patient during the most critical period of the series would be impossible. Should his bowels not move, or should he be troubled with gas or cramps which is not uncommon, he would be tempted to take an enema or a cathartic and possibly fail to return at all, believing this form of therapy not suited to him. He would have formed a completely erroneous idea of the therapy and have little good to say about it to his friends. Therefore, each patient should be given definite instructions at the first irrigation and be made to realize the importance of carrying them out to the letter.

Treatments during the second and third week may be given every other day. After this they may be stopped altogether or the intervals lengthened according to indications. Solutions commonly used are: neo-silvol, 30 grains to the quart; sodium carbonate, one dram to the quart; acid sodium phosphate, one-half ounce to the quart; potassium permanganate, 1-8,000; zonite, one ounce to the quart; sodium thiosulphate, one ounce to the quart; saponified oil, two drams to the quart; pathogenicide, two drams to the quart; b. acidophilus liquid culture, four ounces to the quart.

The use of temperatures as high as 50° C. in the jar, for the medicated solutions, is a much more important point in technique than at first might appear. Apart from acting as a strong stimulant to evacuation, it has been shown that it both increases the local circulation and eradicates all parasites. Schmidt, Beazell, and Ivy[1], working upon dogs, showed that applicator temperatures up to 52.2° C. caused a progressive increase in the circulation up to three times the normal. There was no evidence of tissue injury by these temperatures unless the applicator distended the segment or the segment contracted forcibly upon the applicator. In several experiments in which higher temperatures were employed, the increase in blood flow was less than that observed at 52.2° C., and there was evidence of tissue damage. No change in the rate of lymph flow was observable in any of these experiments.

The conclusions reached were as follows. Mucous membranes can tolerate temperatures that would be definitely injurious to the skin; this is made possible by an active hyperæmia of such magnitude that the heat is readily dissipated. Temperatures of about 52° C. applied locally to mucous membranes stimulated secretory activity considerably, while body temperatures of 41.5° C. induced by diathermy had no measurable effect.

Damaso de Rivas[2] has shown that temperatures of 46° and 47° C. in the intestine cause all known parasites, including the *amœba histolytica,* to relinquish their hold upon the intestinal mucosa and to be evacuated with the irrigation solution. After a cleansing enema, fractional instillations of copper sulphate solution, 1-5000 at a temperature of 50° C. in the jar (allowing for a loss in temperature of 4° C. between jar and mucous membrane), are given through a colon tube introduced six or eight

inches or more into the rectum. Two quarts are given during a treatment. Treatments are given daily at first, then every other day, and finally weekly for several weeks beyond the time when parasites are found upon examination. Copper sulphate is used because of its astringent effect upon the mucosa—preventing undue absorption of toxic material by denuded surfaces—also, because of the well-known fact that sulphates are not readily absorbed by the intestinal mucous membrane.

During a course of treatments the patient should be on a smooth soft diet, should take no laxative of any kind, should rest a great deal, and should be free from unusual strain or worry which might cause him to become spastic. It may be necessary to give an antispasmodic two or three times daily, or a mild nerve sedative and possibly supportive medication of some kind. The patient should report periodically for three to six months for guidance, advice and an occasional treatment if necessary, for there will be a tendency to relapse in most cases until the bowel has fully regained its resiliency and functional rhythm. Should it be found necessary to give a laxative for a while, the mildest stimulant which will do the work is the best. The mechanically-acting bulk laxatives may be tried first. If they are ineffective, cascara, senna, rhubarb, milk of magnesia, aloes or bile salts may be tried.

REFERENCES.

(1) SCHMIDT, C. R., BEAZELL, J. M., and IVY, A. C.: "Effects of Heat Applied by the Elliott Treatment and Short-Wave Diathermy on Blood and Lymph Flow of Intestine and Colon" (an Experimental Study in the Dog). *Arch. Phys. Ther., X-ray, Rad.* 18: 677-683 Nov.), 1937.

(2) RIVAS, DAMASO DE: "The Treatment of Parasitic Infestation of the Colon by Means of Colonic Irrigation and Hot Instillations." Read before the Am. Congress of Phys. Ther., Cincinnati, Ohio (Sept. 22), 1937.

Hyperpyrexia in Rheumatic Diseases

E. Engel (*Zeit. f. Rheumaforschung*, 1938, i, 322), finds that treatment by production of hyperthermia is indicated in all chronic rheumatic diseases, such as primary or secondary chronic rheumatism of the joints, gonorrhœal arthritis, spondylitis ankylopoietica, arthritis deformans, muscular rheumatism, neuritis and neuralgia. Hyperthermia produces leucocytosis, sometimes an increase and sometimes a decrease in the sedimentation rate, lowering of the blood pressure, the diastolic more than the systolic, an increase of the blood-sugar, a decrease in the amount of blood cholesterol, an increase of the basal metabolic rate, and a loss of sodium chloride. The number of baths should vary from 7 to 12, given at intervals of 3 to 4 days. More than three baths a week should not be given, and the temperature should not be raised above 40° C., except in nervous diseases, when it may reach 41° C. The author has treated 108 cases of rheumatism by means of hyperthermia, with the following results:

Disease.	No.	Cured.	Improved; able to work.	Moderately Improved.	No Result.
Acute polyarthritis	18	17	1	—	—
Chronic polyarthritis	22	—	20	1	1
Arthritis deformans	32	—	22	7	3
Sciatica	12	8	3	—	1
Muscular rheumatism	16	10	4	2	—
Spondylitis deformans	5	—	3	—	2
Humero-scapular periarthritis	3	2	1	—	—
	—	—	—	—	—
	108	37	54	10	7

No drugs, except the salicylates, were given in three cases of acute polyarthritis. The treatment was begun by a six-day fast, during which only fruit juice was permitted. During the treatment by baths the diet was as free as possible from albumen.

PHYSIOTHERAPY and ORTHOPAEDICS

PART II

BY W. SAYLE CREER, M.CH. (ORTH.), F.R.C.S.

UNUNITED FRACTURES

CERTAIN fractures have long held a reputation for a liability to delayed union or non-union. One may mention the carpal scaphoid, the junction of the middle and lower thirds of the ulna, the same area of the tibia, the neck of the femur, the patella, and the shaft of the humerus. Many factors may cause non-union. The bony fragments may not be in contact because of simple malposition, because of loss of fragments of bone or because other tissue, such as muscle, is lying between the bones. But in this section we are considering non-union from no apparent cause and that in which the position of the bones is good.

Until the advent of X-rays the subject was one of mystery. As soon as we had the benefit of being able to see what actually happened to a fracture, a number of facts emerged. The first and most important was that the period of time taken for a fracture to unite varied considerably with different bones. The clavicle becomes firmly united in about three weeks, while the shaft of the tibia takes eight to twelve weeks, and the neck of the femur three to six months. This at once made it obvious that some of the cases of non-union were not non-union at all but merely that we expected union to be complete long before it could be.

The second fact was that non-union cases should be divided into (1) delayed union, and (2) non-union. Where the X-rays show that the surfaces of the bony fragments on each side of the fracture are dense or sclerosed, i.e., have formed a false joint, no union can take place unless the fragments are "freshened" by removal or breaking-up of the sclerosed bone. In actual treatment one inserts a bone-graft as well, in order to secure perfect fixation and immobilization. These cases are true non-union. Where X-rays show that there is no sclerosis, no operative efforts are essential. Operation may accelerate union, but, provided complete and unremitting immobilization is maintained, the bones will ultimately unite. These cases are not non-union, but delayed union of the fracture.

The third fact was one already mentioned—that splintage had to be adequate and unremitting. The fourth was that, if the splinted limb could be made to "function" to the maximum extent allowed by the splintage, union took place with the greatest rapidity. It is quite a simple matter to tell whether a patient has been exercising her arm or walking on his fractured tibia. Lack of "functional exercise" causes osteoporosis, which means the absorption of bone in small areas, leaving it more or less like a piece of the now-familiar sorbo rubber. Osteoporosis shows in the X-ray films a mottled appearance. Obviously, if this absorption is taking place in the whole bone, union of the fracture will be retarded or even prevented. A few weeks of concentrated exercises, or of walking, rapidly restores the bone to normality, as evidenced by the clear, even texture of the X-ray shadows.

This rather long explanation has been necessary to make the subject clear, and to explain why it is that nowadays, with greater emphasis on the strict and continued immobilisation of fractures for adequate periods accompanied by appropriate

"functional use," non-union of bones with the fragments in good position has almost ceased to exist. Strict immobilisation may entail special methods, such as the use of a tri-flanged nail for fractures of the neck of the femur, or of fixation of the fractured patella by silk or catgut sutures.

The subject is of interest to the physiotherapist because, until quite recent years, surgeons used to send their cases of delayed union or non-union to the massage department for "damming and percussion." The damming was effected by applying above the site of fracture, a tourniquet of such tightness that the veins were obstructed but the arteries left patent. After as long a period as the patient could tolerate—from ten to thirty minutes—the tourniquet was removed and the fracture was hammered by means of a heavy headed percusser with a flexible handle. The theory was that the venous obstruction assisted the union of the bone in some way and that the hammering stimulated the bone cells. Although it appeared to have some good effects, one wonders whether the results were not merely coincidental, and whether union would have occurred despite the treatment. The method has now been abandoned because we do not now expect certain fractures to unite so soon as was formerly the case, and not at all if they are not treated adequately. Non-union always requires some form of operative treatment.

POST-OPERATIVE TREATMENT

In this section a variety of rather unrelated general orthopædic conditions will be discussed. The treatment of special subjects such as nerve lesions and muscle and tendon transplantations will follow in a subsequent section.

It is difficult even to give any principles governing the whole group, except the ever-recurring ones of restoring muscle tone and the vascular reflexes. We will deal with these piecemeal.

The Upper Limb

There is little scope for physiotherapy in the upper limb. Most of the operations are for fractures of the bones of the forearm or of the elbow, for injuries of nerves or in order to transplant tendons. The same rules as for closed fractures apply after open reductions, and do not require reiteration. The nerve and muscle cases are discussed later. One might mention recurrent dislocation of the shoulder. It has been stated that more than seventy operations have been described for the "cure" of this condition. Nearly all of them involve considerable cutting of tissues of, and around, the shoulder-joint and one would expect that the joint would develop adhesions if not treated by appropriate measures. Despite immobilisation of the joint for six weeks, as required by most methods, stiffness is exceedingly rare. With nothing but the patient's own exercises, full movement is recovered in a very short period. Perhaps there is some inherent extra freedom in these cases which is part, if not the whole, of the reason why dislocation so easily occurs. For, despite many theories, we really do not know why the dislocation happens.

A reason for general measures, such as general arm and leg exercises and deep breathing exercises, is the prevention of pulmonary thrombosis. Gynæcological and fracture cases are especially liable to lung complications. Apparently the inactivity, so frequently necessary after childbirth and fractures of some of the larger bones, allows the blood stream to stagnate in certain of the deep veins of the body. A blood clot may form and, when the patient starts to move about in bed more freely, this is dislodged. It travels to the lung and, depending on its size, causes slight or severe obstruction or even death. The gynæcologist is more concerned about the matter than the orthopædic surgeon. Many of them make sure that this "accident" will not take place, by arranging for a masseuse to visit the wards each morning in order to put the

patients through a series of exercises for the arms, legs and chest. Since it was introduced, this simple expedient has completely eliminated pulmonary thrombosis or embolus in at least one hospital.

The lower limbs offer more scope for physiotherapy.

The Knee-Joint

An exceedingly common orthopædic operation is the removal of one of the semilunar cartilages of the knee-joint. There are almost as many routine after-treatments as there are surgeons, though they fall into two large groups. At one time it was customary to apply a splint to the knee for three to four weeks, and, after its removal, to arrange for massage, heat and exercises to restore movement to the joint. But full movement and power is not regained for two or three months, so this is gradually giving way to another general routine which allows of early ambulation. As in all painful conditions of any joint, one of the effects of the operation is to cause a reflex inhibition of the tone of the quadriceps muscles. Probably in no other joint does such reflex inhibition cause so much trouble. The quadriceps muscles, which extend the knee, are the most important muscles controlling this joint. If they are weak, the patient cannot stand or walk, and, moreover, the joint becomes filled with an excess of synovial fluid as soon as the patient attempts to stand. If we put him back to bed the effusion disappears, only to reappear at once when he gets up. No bandage will control it, or at least the bandage will have to be so strong that he cannot use his knee as a joint.

Our measures to combat this fall once more into the category of prevention rather than of cure. Many surgeons make their patients start voluntary active exercises for the quadriceps muscles within one or two days of the operation. The masseuse, the sister or the house surgeon devote a few minutes each day to the supervision of the exercises, which are graded in severity as the days pass. The knee has, of course, been operated on and, to prevent bleeding into the joint and tissues, a firm compression bandage consisting of several alternate layers of wool and bandage will have been applied. The bandage and the recent operation wound will not allow of movement of the knee-joint. The exercises must, therefore, be " static quadriceps exercises." The first and easiest consists of alternate contraction and relaxation of the muscles. Small rapid twitchings are useless. One must make the patient tense his muscles firmly and hold them thus for several seconds. They are then relaxed for a brief period in order to rest them. Fatigue must be avoided. On the first day, great encouragement verbally and by demonstration on one's own knee and the patient's unoperated knee will be required. On the second day he should be able to perform them well. If not, he is slacking, and the necessity and reason for the exercises must be drilled into his mind.

By the third or fourth day the second exercises should be commenced. The patient is told that he is to lift the leg with extended knee till the foot is 6 inches off the bed and to hold it there for a few seconds. This is to be repeated many times with intervals to prevent fatigue. The masseuse assists this exercise the first time or two by placing the hand under the heel as the patient attempts to lift. After two or three attempts, assistance to raise the leg is given by placing one or two fingers against the sole of the foot just behind the metatarsal heads. This feels a rather insecure " hold " and unconsciously stimulates the patient to greater efforts to ensure that the leg will not be allowed to fall. In the average case it is possible deliberately to slide the finger away after the leg has been raised five or six times, and the patient finds to his surprise and delight that his muscles are powerful enough to support the leg by themselves. From now on the progress will be rapid under the stimulus of obvious improvement, and, on the sixth day, the third exercise is commenced. This consists of crossing the normal leg over the other so that the feet are crossed. The patient is instructed to use

his normal leg to resist raising of the other. He is told to " make them fight against one another." The object of this exercise is to increase the resistance against the quadriceps and this could also be obtained by placing conveniently-shaped weights on the leg. The former method is simpler in that no special apparatus is needed, and also because the patient can continue to practise it at all times of the day underneath the bed-clothes cage.

All patients treated along these lines are able to commence walking after 10 days. Some surgeons encourage careful walking exercises, but without much flexing of the knee, two days after the operation. It is not usually necessary to give any further treatment after leaving hospital, provided that the patient is intelligent and will continue the exercises at home. He bends the knee progressively according to symptoms. The average period for return to work is five weeks, though patients have played such games as tennis three weeks after the operation.

It must not be thought that all cartilage cases recover as rapidly as the above suggests. In districts where torn cartilages occur almost exclusively from football or other sports injuries, the figures do apply. But, in colliery areas a large number of the patients have been at work in the pits. Most of them are rather older than in the other group, and, in addition to the torn cartilage, are suffering from osteoarthritis due to the constant trauma of the kneeling positions which they have to assume. It is almost true that such men seldom return to the pit. The reason lies in the osteoarthritis and not in the operation. At best they will require a fairly prolonged period of physiotherapy, such as is given to any osteoarthritic patient.

Minor Foot Deformities

All orthopædic surgeons have to treat many cases of minor foot deformities, such as hallux rigidus, hallux valgus and hammer toes. It is of inestimable benefit if physiotherapy is given after operation for these conditions. The foot has to do more work than any other part of the body. It is a small complex structure of bones and joints, acted upon by, and dependent for function on, muscles which arise for the most part outside the foot. At each step one foot supports the whole body weight. The necessary rest after operation causes rapid and marked loss of tone in these muscles and in the blood vessels, and reduces the efficiency of the normal reflexes. While it is true that the majority of cases will recover without any treatment, it cannot be denied that in all cases convalescence will be reduced by a very considerable amount, if attention is paid to the restoration of muscle and vascular tone. This is particularly true in elderly patients, who form the greater proportion of cases. The necessary treatment is heat to soothe and to increase blood flow for metabolic purposes; massage for the same reason and to remove oedema or effusion and to help in the absorption of exudates; and, most important of all, exercises to restore mobility to joints and power and tone to muscles, and to re-educate reflex-actions. Faradic stimulation by the Bristow coil or by baths is also of some value, but the latter cannot replace exercises.

In other post-operative cases we may have to restore movement to joints, which have had to be immobilized for a long period, or to educate muscles to perform some new function, as explained in the next section.

(To be Continued)

Owing to pressure on space, the paper by Dr. L. G. H. Sarsfield, continuing the series on " Electro-Medical Apparatus," has been held over from this issue, as well as a paper by Dr. P. P. Stock on " Short-Wave Therapy in the Treatment of Asthma."

MINOR DISPLACEMENTS OF THE PHALANGES

By EDGAR CYRIAX, M.D. (Edin.).

ALTHOUGH major displacements (true dislocations) of the phalanges have received due recognition by the profession, I do not think that enough attention has been directed by the latter to minor displacements (subluxations) thereof. These, however, are fairly common and frequently remain unrecognized.

As far as I can see, there is no reason, either anatomical or physiological, why such minor displacements should not occur in any of the metacarpo-phalangeal or inter-phalangeal joints, but by far the commonest sites are the metacarpo-phalangeal joint of the thumb and the distal inter-phalangeal joint of the little finger.

The cause of these subluxations, in practically every case, is traumatic (blows, falls or stubbing). I have only met one case in which muscular action appears to have produced one. Concerning the direction of the displacement, in the case of the meta-carpo-phalanageal joint of the thumb, this is usually lateral, with or without a minor degree of rotation and seldom purely rotary; in the case of the last phalanx of the little finger, it is almost always in a forward direction.

Symptoms

The symptoms very closely resemble those of an ordinary sprain, so much so that they are often mistaken for one, but, instead of subsiding fairly quickly, they either do so very slowly or not at all; indeed in some cases they may even get worse—and the patient is left with persistent discomfort or pain, both of which are aggravated by movement, limitation of both active and passive movement, and sometimes grating noises which are manifested when either or both of the latter movements are attempted.

Signs

There are three signs, however, found in such minor displacements which are not ordinarily present in sprains uncomplicated by such subluxations: (1) On attempting passively to execute the normal movements of flexion, extension, abduction, adduction and rotation in the subluxated joint, one can detect limitation of one or more of these movements, such limitation ensuing abruptly and not gradually as in a normal joint: (2) Passive movement of a displaced bone, as if to increase the deformity, nearly always induces pain or aggravates it if already present, whereas the reverse happens if the movement is performed in the opposite direction: (3) Bony deformity is present in the affected joint, and one or more edges of the proximal bone will be too prominent. This may, of course, be detectable only after careful comparison with the other hand. This apparent outgrowth of bone may lead one to suspect arthritis.

Skiagrams are not always satisfactory, as slight degrees of subluxation, especially in the thumb, may be almost indistinguishable from normal irregularities.

Treatment

With regard to treatment the only radical cure, as with displacements of bones elsewhere, is reposition. The technique is as follows: Having made an accurate diagnosis of the precise direction of the displacement, efforts are made to move the bone in an opposite direction, i.e., towards its original correct position. But—and this is very important—before attempting any such manœuvre, the opposing surfaces of the joint involved

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must be separated. This is brought about by the operator grasping the bones above and below the affected joint with the thumb and forefinger of each hand respectively and pulling in opposite directions. I may here state that in some cases this manœuvre *per se* will allow of reposition taking place. This elongation must be continuously maintained during the whole time that efforts are being made to restore the subluxated bone to its correct place.

As a rule, the reposition ensues absolutely painlessly. At the moment of its occurrence an articular sound, varying greatly in pitch and intensity, is usually clearly heard. After reposition an immediate relief, partial or even total, of all the symptoms may result.

In the case of the thumb, a short after-treatment on the same lines as that applicable to ordinary sprains may be needed. In the majority of cases of subluxation of the distal phalanx of the little finger, this is seldom necessary, as reposition there and then effects an immediate and permanent cure in most cases.

A CRITICAL REVIEW OF THE THERAPEUTIC ACTION OF HIGH-FREQUENCY CURRENTS
—continued from p. 10.

a leg of mutton was cooked more evenly and better than by modern methods, the infra-red radiation from the coal fire, applied to the surface of the joint, generated surface heat which was transmitted by conduction to the depth of the bone. Somewhat similarly for the production of hyperpyrexia by physical means, the administration of heated and conditioned air has been found to be safer, more pleasant, and more effective than the application of short-wave therapy.

On the other hand, the view of a dynamic action of high-frequency currents opens up a wide range of therapeutic possibilities, as we acquire the means of applying these currents at a higher voltage and a shorter wave-length. It is along such lines, rather than upon a thermal basis, that our researches should be conducted.

The above views are put forward with a very keen appreciation of the difficulties attending a clear and accurate interpretation of the action of high-frequency currents and with a full realization of the many physical, clinical, and biological pitfalls that bestrew the path of the unwary exponent. But it is the hope of the writer that any errors into which he may have fallen may at least serve to justify the dictum that "Truth comes more easily out of error than out of confusion."

REFERENCES.

BORDIER, H. " Neodiathermie et Ondes Courtes," 1936.
BAYLISS, W. " Principles of General Physiology," 1918.
BUGNARD, L., and HILL, A. V. " The Effects of High-Frequency Excitation of Nerve. *Journal of Physiology,* Vol. 83, No. 4, pp. 383, 394 and 406, 1935.
HILL, A. V. " Chemical Transmission in Nerve," 1932.
BORDIER, H. " Précis d'Electrothèrapie," 1902.
BORDIER, H. " Diathermie," 1934.
ELLIS, J. P. " Electrosurgical Currents and the Histology of Electrosurgical Wounds." *Principles and Practice of Physical Therapy,* Vol. II, chapter 19.

A CALL FOR ACTION—*contd. from p. 1*

who are trained in the use of radium and X-ray treatment should, as Dr. Iredell hopes, stimulate protagonists of physical medicine to press a claim for official interest in the wider subject of physical medicine in general.

Dr. Iredell has raised a cry to which we most heartily add our voice. Let us hope that this combined voice will not prove to be one which is crying in the wilderness.

THE MAGIC OF INVISIBLE RAYS: LECTURES BY Dr. L. G. H. SARSFIELD AT THE ROYAL SOCIETY OF ARTS

The Christmas lectures for juveniles at the Royal Society of Arts were given this year by Dr. L. G. H. Sarsfield, the author of the series on "Electro-Medical Apparatus; its Character, Operation and Care," which has been a feature of this *Journal* for several months. These Christmas lectures for young people are a traditional event of the holiday season, and, from the interest and enthusiasm aroused this year, there was no doubt whatever of the impression made upon their young minds. The subject of Dr. Sarsfield's lectures was "The Magic of Invisible Rays," and during the earlier part of his first lecture he was able, through the co-operation of Messrs. Ilford, Ltd., to give an arresting example of the use of infra-red rays by photographing his audience while the hall was in darkness. As an example of modern instantaneous photography this photograph was taken in 1/75th of a second and without any requests to the audience to keep still. At the close of the lecture the photograph was flashed on the screen, and members of the audience were able to recognize themselves.

Dr. Sarsfield explained many of the every-day phenomena such as the constitution of the rainbow and the wireless waves and cathode rays which are employed in television. Among many other fascinating aspects of his subject, he dealt with the question of the "death ray," and reassured his audience that no ray of sufficient power was yet known which could prove of danger in this connection.

In the second lecture, Dr. Sarsfield exhibited part of the ultra-violet equipment which was employed for the treatment of King George V during his convalescence at Bognor Regis, in 1929; he showed also a series of pictures demonstrating how X-rays are employed at Woolwich Arsenal for the detection of flaws in metals; he further explained that all blank cartridges used at military tournaments are tested to ensure that they are safe; and demonstrated an instrument which is able to discover the presence of the most minute amount of radium.

PHYSICAL MEDICINE GROUP OF THE BRITISH MEDICAL ASSOCIATION

The following have been elected to form the Physical Medicine Group Committee of the British Medical Association for the ensuing three years:—

Dr. P. Bauwens, Sir H Gauvain and Dr. C. B. Heald (members predominantly engaged in the practice of electro-therapeutics and light therapy); Dr. J. B. Mennell, Mr. Harman Taylor and Sir Robert Stanton Woods (members predominantly engaged in the practice of massage, medical gymnastics and physical training); Dr. K. R. Collis Hallowes (President for the time being of the Section of Physical Medicine of the Royal Society of Medicine); Dr. C. W. Buckley (appointed by the Spa Practitioners' Group); and Dr. S. Cochrane Shanks (appointed by the Radiologists' Group).

REMEDIAL EXERCISES IN MEDICAL PRACTICE

An interesting demonstration of remedial treatment, arranged by the London Branch of the Chartered Society of Massage and Medical Gymnastics, was held at the Middlesex Hospital on the 16th December last. A feature of this was the fact that the application of remedial exercises in conditions other than orthopædics was emphasized. For example, a demonstration was given of how ballet dancing technique can be applied to the correction of foot defects and the posture problems arising therefrom, and to which ballet dancing can give rise. A range of exercises designed to assist normal labour was also shown. Another important condition in which exercises prove useful is asthma. It was shown that patients must be taught how

Contd. on p. 28

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

Biological Significance of U-V-R in Direct and Diffuse Sunlight

W. Amelung and W. Kuhnke (*Deuts. med. Woch.*, 1938, lxiv, 1345) find that a great part of the long wave U-V is active in the formation of erythema. Artificial sources of light are not of the same value biologically as sunlight. Sky irradiation is of the greatest curative importance: its part in U-V-irradiation is very great in the transitional months. Shadow irradiations might be of biological value. The extent of the horizon is more important for the strength of the U-V-irradiation acting on the body than exposure to direct sunlight or the direction of the sky on a room.

Physical Therapy in Fractures

F. D. Dickson (*J.A.M.A.*, 1938, cxi, 1016) draws attention to the four chief forms of physical therapy, i.e., heat, massage, exercise and muscle stimulation, which may be used in the treatment of fractures. Heat should be employed at a low intensity and over a long period by the use of a therapeutic lamp, diathermy, electric light or by light bulbs in a cradle. The type of massage most useful is light stroking massage always in the same direction and directed proximally. Light and very gentle kneading may be utilized. Muscle stimulation may be brought about by voluntary effort or by electrical stimulation, but the former can only be used to a limited extent. When electrical stimulation is employed to produce muscle contraction, it should be painless. Physical therapy is chiefly valuable in the post-reduction period and also in after-treatment.

Care and Prevention of Rheumatism

H. Gehlen (*Forsch. d. Therap.*, 1938, xiv, 595) describes the meeting at Stuttgart of the German Society for the Prevention of Rheumatism. Directions for the individual prophylaxis of rheumatism, its early recognition and causal treatment, were considered, and some of the speakers maintained that endogenous factors and injurious surroundings, as well as factors connected with work, were the chief causes of rheumatism; whilst some believed that infection, especially focal, played a predominant part. One speaker believed that the best prophylaxis against rheumatism was active production of hyperæmia in childhood by physical treatment, exercises, hardening processes and a diet rich in vitamins, and the prevention of focal infection from the teeth, gums and tonsils. Other speakers referred to the special care (e.g., clothing, diet, method of living and housing) necessary in the case of those who had undergone previous illnesses or operations.

The Colloidal Gold Curve of Spinal Fluids After Ultra-Violet Irradiation

J. Warren (*Jour. Lab. and Clin. Med.*, 1938, xxiii, 1146) found that irradiation of normal spinal fluids by U-V-R produced no significant change in the colloidal gold reaction of such fluids. When spinal fluids, giving paretic curves, were irradiated, the amount of gold precipitated was decreased in the highest concentrations. Fluids with syphilitic colloidal gold curves showed, after irradiation, a decreased precipitation in the middle dilutions and increased precipitations in the highest concentrations.

Sciatic Pain of Unknown Origin

G. E. Haggart (*Jour. Bone and Joint Surg.*, 1938, xx, 851) found that the following treatment gave the best results in cases of sciatic pain for which no cause could be discovered. He combined two and sometimes three of the following procedures: (1) Perineural injection of the sciatic nerve with novocain (1 per cent. solution); (2) traction to the affected extremity; and (3) manipulation of the lower part of the back under intravenous pentothal anæsthesia. Points of insertion of the needle were determined by the intersection of a line projected from 3 inches (in the male) to 3½ inches (in the female) directly laterally from and at the level of the apex of the intergluteal fold and perpendicular from the ischial tuberosity, and another line from the mid-lateral aspect of the greater trochanter to the spinous process of the fifth lumbar vertebra. Three needles were used, one in the centre, so as to anæsthetize the fascia of the gluteus maximus and the piriformis muscle. The patient then went to bed, and skin traction was employed by a weight of 25-50 pounds for the first 36 hours, then reduced to from 10-15 pounds. Manipulative procedures were always performed under general

anæsthesia, preferably by pentothal. In 15 cases, perineural injection of the sciatic nerve was employed, and this gave immediate relief, eleven patients being free from pain for 20 months. In 27 cases, the same method with traction was used: 16 had no recurrence after a year and 12 after two years; 7 received temporary relief, and 4 were not benefited. Thirty-three patients were submitted to perineural injection followed by low-back manipulation: in 19 cases no recurrence took place, 3 were free from pain for from 12-18 months, 5 from 3-6 months, and in 6 no benefit accrued.

Fever Therapy by Electrical Means

Vassiliadis, H. C. (*Chinese Med. Jour.*, 1938, liv, 271), describes cases he had treated by means of electrical hyperpyrexia. He finds the physiological effects to be as follow: an increase of pulse and circulatory rate, the increase of the former depending on the temperature of the skin; a raised systolic and a lowered diastolic pressure; increased concentration of the blood volume and increase in the viscosity of the blood; a slight increase in the number of the red and white cells, the latter being due to a greater number of neutrophils; a decrease in number of the lymphocytes; a transitory increase of the non-protein nitrogen, urea, and creatinine, due to the concentration of the blood; a similar increase in the Ca, blood-sugar, and P; a decrease in the blood chlorides and in the carbon dioxide combining power of the plasma; a considerable loss of chlorides in the gastric secretion, with an increased amount of lactic acid in the perspiration; and a greatly increased metabolic rate.

Physical Therapy in Dermatology

H. D. Niles (*Med. Clin. N. America*, 1938, xxii, 1311) discusses the following treatment of skin diseases by physical therapy: (1) Ultra-violet radiation. The best results in most dermatoses are obtained by solar irradiation or by artificial irradiation by the carbon-arc lamp or air-cooled quartz lamp. U-V-R is the only method which shortens the treatment in pityriasis rosea. The cold-quartz lamp can be used with an applicator in body cavities. This lamp often aborts the development of early pustules of acne vulgaris and hastens the healing of impetigo contagiosa. Generalized U-V-R has a tonic effect in furunculosis, tuberculosis cutis, Bazin's disease and deep sarcoids. The entire body should be irradiated in these diseases. Ultra-violet light is probably the best treatment for erysipelas. Lupus erythematosus, herpes and some other skin diseases are often aggravated by solar or artificial ultra-violet irradiation. (2) Electrolysis. This is chiefly used for hypertrichosis and small nævi. (3) High-frequency currents or surgical or medical diathermy. The former comprises three forms: (a) Electrodesiccation in the treatment of warts, keratoses, nodules of lupus vulgaris, and other skin lesions. After its use, it is usually desirable to curette the dehydrated remains of the former lesion and desiccate the base; (b) Electrocoagulation: this is used in cases of deep, malignant growths and hæmangiomata; and (c) the cutting current: this is employed for removing pedunculated growths and cancers. Medical diathermy is of little use in dermatology, but the high-frequency Oudin current, applied through a vacuum-glass tube, seems to give better results than U-V-R. (4) Solid carbon dioxide is used for destroying pigmented and vascular nævi, warts and keratoses. (5) Heat. Hot, wet dressings are helpful in furunculosis, sycosis and acne vulgaris. In acute dermatitis and moist eczema, constant hot dressings with various salts are of great benefit. (6) Balneotherapy gives relief to patients suffering from itchy dermatoses, but is not curative. Bicarbonate of soda should not be used in the bath. (7) Massage. This method is limited to the treatment of keloids, hypertrophic scars, sclerodermia and various forms of alopecia. In sclerodermia, this method frequently gives better results than any other.

Treatment of the Sequelae After Accidents by Combined Physical Methods

Caruette (*Ann. de méd. phys. et Rheum.*, 1938, xxxi, 93) recommends blue light and radiant heat, especially Dowsing lamps and infra-red, for the pain following injury. Infra-red should be employed at first daily for from 15-20 minutes, and then radiant heat alternating with infra-red rays. To restore functional activity, mechanotherapy, especially Zander's exercises, are recommended. Massage and galvanization also have their value. In articular troubles, hydrotherapy, passive mechanotherapy, fever therapy by means of diathermy and short-waves, have their place. With nervous symptoms, phototherapy and electrical currents are valuable. When circulatory symptoms are present, fever therapy, massage, paraffin therapy, and hydrotherapy are worthy of trial: in cutaneous affections, ionization and X-rays should be employed.

REVIEWS of BOOKS on Physical Medicine and Allied Subjects

The Thinking Body

The Thinking Body: A Study of the Balancing Forces of Dynamic Man. By Mabel Elsworth Todd, New York. With Foreword by E. G. Brackett, M.D., Boston. 314 pp., 91 illus. Price 22s. 6d. London, 1938: Constable & Co., Ltd.

The author has not only been teaching for 30 years, but it is evident that she has also learnt and reflected for a similar time. She shows originality in her theories and scientific probity in testing their validity.

The sub-title indicates the scope of the book. The stages by which "form follows function" are traced from early forms of life to man. The human skeleton is described in detail, attention being drawn to mechanical implications. The metaphors used are clear and useful. On page 66 it is stated that "the nature of the mechanical problems presented by the upright position is best understood by comparing it with the four-footed position, and noting the changes in weight thrust brought about by the shift.

There are three, and only three, ways in which weights may be supported in any structure. They may sit, they may hang, or they may be braced. Stiffness must be a quality of the supporting members for sitting or braced weights. The upward thrust against a sitting weight must be vertical and against a braced weight diagonal. In the arched support, the thrusts must be diagonal and bilateral. A hanging weight must be suspended in a vertical line from its support, but it may hang on either flexible or rigid material.

The skeleton supports weights in all three ways: the head sits upon the spine; the arms hang from the shoulder girdle; and the ilia brace the sacrum." . . .

Breathing claims a special chapter of its own.

All the ordinary positions and movements (standing, sitting, moving, etc.), are analysed and commented on. The questions of how fatigue is produced and of its avoidance is discussed.

On page 77 the following occurs:—"The solution of the human structural problem depends primarily upon mechanical principles of dynamics and statics, applied in the same way as in any successful building, bridge or skyscraper, modified only by physiological and psychological factors. Bones are the weight bearers. Both at rest and when operated as levers in movement they transfer and control weights at the joints. In such situations they are the compression members, and should be so used. All the other structures involved in the movement and arrangement of bones, including muscles, ligaments and fascia, are the tensile members, and should be freed as far as may be from the direct support of weight."

Page 283: . . . "Old words, old fixities, traditions of a past age, must give way to new realizations of facts or truths as they relate to modern living. The old military posture, with its implication of stiff discipline, has given way to a more alert erectness, dynamic instead of static, favouring a better acquaintance with natural functionings of the living structure."

The author has also some interesting and provocative views on the interaction of mind and body.

This book comes at an appropriate time, when physical fitness has a large place in the nation's mind. The need for correcting the C3 posture is constantly before our eyes as we see the "man in the street" and the slouching youth. The "how" is always the most difficult part of any problem, and this volume has much to teach. "Publish it not in Gath," but as one observes the posture and movements of many members at any medical meeting it is noticeable that the medical profession itself has still much to learn and practise. M.E.O.

British Journal of Physical Medicine

Title Page and Index, Vol. 1. New Series

The title page and index to Volume I of the New Series of *The British Journal of Physical Medicine* (January to December, 1939) will be published in February and forwarded to subscribers with that issue of the *Journal*.

Binding Cases for Volume I of the New Series will also be available in the new size, and subscribers wishing to have their copies bound may forward them to the *Journal* offices for this purpose, as previously. Full particulars will be published in the February issue of the *Journal*.

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Letters are welcomed on all matters of general interest. Publication does not necessarily imply that the Editors agree with the views expressed.

Northwich Orthopædic Clinic

To the Editor,

The British Journal of Physical Medicine.

Sir,—At the risk of labouring the subject of pioneers, I should like to call on your good offices for a little space. The Northwich Orthopædic Clinic was opened in 1919 (then called Mid-Cheshire Orthopædic Clinic), and since that date it has been open daily from 9 a.m till 7 p.m., so that working people can come for treatment without loss of working time. Also a recommendation from a doctor for every patient treated has been and is a necessity, seeing that only a fully qualified staff is employed.

Though we may be pioneers in these respects, we hesitate to claim the distinction, at it seems difficult to know what our neighbours may be doing on similar lines in other parts of the country.

It is good to know of an increasing number of such clinics being established for the benefit of the public.

I am, yours, etc.,
WINIFRED BERRY
(*Sister-in-Charge*),
NORTHWICH ORTHOPÆDIC CLINIC.

Northwich, 23rd December, 1938.

THE SOCIETY OF PHYSIOTHERAPISTS

The next meeting of the Executive Committee of the Society will be held on Wednesday, 25th January, at 6.15 p.m. Among other things which will have the attention of the Committee is the question of holding post-graduate lectures for physiotherapists. Details of this proposal were given in the December issue of the *Journal*, as follows: "Apropos of several requests from members of the Society to arrange something of the kind, the Executive Committee, at the December meeting, considered the question of holding, in the New Year, post-graduate lectures for physiotherapists. The Committee were of the opinion that such lectures would be possible if the necessary support was obtained, and they agreed to ask members of the Society, through the medium of the *British Journal of Physical Medicine*, to what extent such lectures would receive their support. The Committee thought that the whole subject of physiotherapy should be dealt with in due course, but that the first lectures should deal with short-wave therapy, a subject on which many physiotherapists were seeking instruction and knowledge; also that each subject should be dealt with both from the physical and clinical aspects and demonstrations of the actual working of apparatus concerned be given by the lecturers. . . . The usual fee for lectures of this kind will be charged, and it may be possible to

Contd. on p. 30, col. 2

REMEDIAL EXERCISES IN MEDICAL PRACTICE—*contd. from p. 23*

to relax before they can properly learn suitable and beneficial breathing exercises. A film was shown which demonstrated the use of pulleys and slings as employed by Mrs. Guthrie Smith in the after-treatment of poliomyelitis. Other interesting demonstration were those of Miss Bristow on the use of short-wave therapy in sinus infections, and Miss B. Copestake, who employed Pistany mud packs in the treatment of arthritis and sciatica.

RHEUMATISM SECTION AT THE HOSPITALS, NURSING, MIDWIFERY AND PUBLIC HEALTH EXHIBITION

The forthcoming Hospitals, Nursing, Midwifery and Public Health Exhibition and Conference (Feb. 13th-17th, 1939), which is being held as usual at the New Horticultural Hall, will this year include a Rheumatism Section. This section is under the patronage of the International Society of Medical Hydrology, the International Spa Federation and the Empire Rheumatism Council.

The section will be divided into four subsections: (1) Non-articular; (2) Articular; (3) Gout and Rheumatic Fever; (4) Films, Spas and Photographs.

Lectures will be given on Wednesday, 15th February, as follows: 11.30 a.m.—*The Problem of Rheumatism in relation to National Health*, J. F Halls Dally, M.A., M.D.; 12 noon—*Rheumatism in Childhood*, F. John Poynton, M.D., F.R.C.P.; 2.30 p.m.—*The Treatment of Chronic Rheumatism*, W. S. C. Copeman, M.D., F.R.C.P.; and 3.30 p.m.—*The Rheumatic Backache*, Gilbert Scott, D.M.R.E. Tickets for this Section can be obtained from the Organizer of the Exhibition, Nursing Mirror Offices, Dorset House, Stamford Street, S.E.1.

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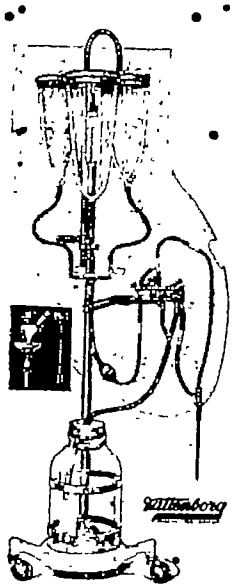
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Society of Physiotherapists

—contd. from p. 28, col. 2

arrange that members who cannot attend receive a report of the lectures, if desired."

Members of the Society who are interested are asked to communicate to the Hon. Secretary their views concerning the holding of such post-graduate lectures, and what they consider a suitable time and day for same. The Committee wish to thank those members who have already communicated their views on this matter to the Hon. Secretary, and would be glad if those members who have not so far written and are interested in the scheme will be good enough to write before the 25th January, so that the Committee, in coming to a decision in this matter, may have the opportunity of considering the views of all interested members.

Dartford Massage and Light Clinic

In the November issue of this *Journal*, under the heading "Dartford Massage and Light Clinic," page 400, paragraph 3, line 3, the number of treatments should have been given as 80,000, not 8,000.

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THE BRITISH JOURNAL OF

PHYSICAL MEDICINE

AND INTERNATIONAL REVIEW

J. I. M./A. 11/3/39

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Original articles are invited on any aspect of Physical Treatment. Such articles are published only on the understanding that they are contributed exclusively to this Journal, *which does not hold itself responsible for statements made or opinions expressed by any contributor. The copyright of all articles appearing in the* Journal *is strictly reserved.*

Facts or Fancies

ON page 43 of this issue of the *Journal* Dr. H. Crichton-Miller makes some provocative statements which suggest that physical medicine depends to an appreciable extent for its effect on the power of suggestion rather than on any inherent physiological actions.

It must be freely admitted that the exact physiological mechanism of action of various physiotherapeutic methods is by no means yet clear. Concerning short-wave therapy, for example, one distinguished group of authorities holds that the results obtained are explainable purely on heating effect; another equally distinguished group is equally emphatic that other important biological factors must be accredited with some part of its value. Similarly, with regard to the older method of ionization much controversy has occurred as to exactly how its effects are produced. To take one more example, a distinguished physiologist (see page 57 of this issue) is quite unable to explain the benefits of massage on any basis which is in accordance with modern physiological knowledge.

But physical medicine is not alone in advocating methods the explanation of which is not fully elucidated. In the realm of therapeutics there are many examples of medicinal agents, employed for long in a completely empirical manner with excellent results—results which, with the advance of scientific knowledge, were later entirely vindicated by a rational explanation of their actions. Many more medicinal agents are still in the empirical stage, yet so outstanding are the results obtained with them that he would be a rash critic indeed who would suggest that they are not worthy of use.

So it is with physical medicine. Practitioners of this comparatively young science are constantly obtaining excellent results from the use of those methods indicated above. We would go so far as to say that physical medicine can proudly claim results in many spheres which the older methods could not achieve. Electrical hyperpyrexia, for example, has been said by one authority to constitute the greatest advance in the control of venereal diseases in the past fifty years. Ultra-violet irradiation has given us an outstanding treatment for such conditions as lupus vulgaris, erysipelas and rickets. Short-wave therapy has proved one of the most effective single methods of treating rheumatoid arthritis, and has given results in lung abscess which for safety, rapidity and excellent end-results are perhaps better than any other method.

Clinical results speak more loudly than theories, and in physiotherapeutic practice there is an incontrovertible amount of authoritative and carefully documented evidence to convince the most sceptical, if he will only stop to examine it.

Reverting to Dr. Crichton-Miller's paper, there is much that is admittedly true in what he says, but this is applicable to every branch of the healing art and fortunately to a small group of patients only. Such patients, in the nature of their disease, make up the bulk of the psychotherapist's clientele. While they occasionally cross the path of the physiotherapeutic specialist, he has to deal chiefly with those who are ill in body, and to such patients he can certainly offer a very large measure of relief and often cure. We are grateful to Dr. Crichton-Miller for his interesting and valuable remarks, but, in view of the large and increasing volume of clinical evidence supporting the intrinsic merits of physical medicine, we can view these remarks in their proper perspective, as Dr. Crichton-Miller undoubtedly intends us to do.

SHORT-WAVE THERAPY IN THE TREATMENT OF ASTHMA

BY J. P. P. STOCK, M.D.

Hon. Physician, Haywood Hospital, Burslem; Hon. Medical Registrar, North Staffordshire Royal Infirmary.

EXPERIMENTAL work on a rotating electrode for short-wave therapy has been described in two recent communications [1], [2]. In each of these papers its use in the treatment of nasal sinusitis was referred to; the purpose of the present paper is to describe more fully some clinical aspects of the investigation.

The investigation which led to the design, trial and final adoption of the rotating electrode was originally undertaken with a definite aim in view. Briefly this aim was the development of a reliable conservative treatment for acute and chronic nasal infections in patients suffering from asthma. The use of a rotating electrode has by no means been confined to nasal therapy, although a total of 303 cases of nasal sepsis has been treated in the course of the investigation. Of this total 83 were cases of asthma, and these form the subject of the present communication. The bulk of the remaining cases were patients who were suffering from some chronic systemic disease in which the nasal pathology was acting as a contributory ætiological cause.

RATIONALE OF ASTHMA REGIME

Before discussing the results obtained in this series of cases of asthma, it must be pointed out that the nasal treatment is only an accessory, although important, part of the general routine treatment employed. The paroxysmal dyspnœa of asthma has many ætiological factors, and even the mechanism of an actual attack should not be regarded as simple. It is, indeed, difficult to see how any single remedy could ever prove consistently successful in so complex a condition, and certainly no claim is made that the rotating electrode is more than a valuable adjunct to treatment. On the other hand, with the full treatment which has been employed, over 90 per cent. of the 83 cases in the series have either become completely free from attacks or any attacks experienced have been of a trivial character. In 40 of the cases, the period of observation has now extended over more than a year.

To obtain these results, it is absolutely essential to carry out the whole treatment in detail. While the short-wave technique has formed the chief subject of this investigation, the general plan of treatment, of which the nasal therapy forms a part, is the work of A. T. Todd [3], [4], and it was at his suggestion that short-wave therapy was first employed. The general therapeutic plan aims at dealing with as many of the ætiological factors as possible. From the standpoint of treatment the most important of these factors appear to be (1), the allergic factor (2), the nasal factor, and (3) the digestive factor. The introduction of short-wave therapy in the treatment of the nasal factor has not only made this much easier to deal with but has also raised the general standard of the results. More recently it has been found an additional help in the treatment of the digestive factor when directly applied to the liver.

The connecting links between these three factors are so subtly forged that it is difficult to consider them separately. An attempt will be made, however, to assess the part played by the nasal factor and to demonstrate the importance of conservative nasal treatment. For a fuller description of the rationale of the treatment as a whole, the original publications [3], [4] should be consulted.

It is generally agreed that an asthmatic attack may be due to an allergic reaction or may be produced reflexly. The reflexes producing bronchial spasm arise chiefly in the nose and digestive tract, but afferent impulses may originate from almost anywhere in the body, or even may be conditioned as in the classic example of the patient who was handed an artificial rose.

THE NASAL FACTOR

The best known and perhaps the most important source of afferent stimuli to the vagal nucleus is the "asthmogenic" area of the nose. The association between nasal pathology and asthma was first noted in 1884, but it was the historic experiments of Brodie and Dixon which demonstrated that, in suitable animals, irritation in the ethmoid region produced reflex bronchial spasm, apparently identical with asthma.

The area of the nose in man from which this reflex may be elicited is variously known as the "asthmogenic" area (Adam), or the "trigger" area (Hazeltine). Roughly speaking, it is represented by that part of the ethmoid above, and including, the middle turbinal. Irritation in this area causes sensory impressions to pass through the sensory part of the trigeminal, via the descending root, to the nucleus ambiguus. The motor fibres of the vagus arise here and provide the efferent path to the bronchi.

It must be borne in mind that the reflex can only be elicited in patients who are actual or potential asthmatics. It cannot be demonstrated in normal subjects.

Myers, in 1929, put forward three points as evidence that there was a clinical connection between the ethmoid and the bronchi. The points were:—(1) that in asthmatics, a spasm could be induced by mechanical irritation of the "trigger" area of the nose (2), the spasm could be instantly relieved by cocainization of the irritated spot, and (3) a spasm induced in this manner showed fairly strict lateralization corresponding to the side of the nose which was irritated. On the other hand, these points do not prove that spontaneous attacks arise in this way. We know that the reflex is there, but to prove its significance in the production of attacks in patients requires further evidence. Such evidence may be found in the immediate relief of a spontaneous attack by nasal therapy alone. When investigating this point I frequently found it possible to relieve status asthmaticus by packing the superior meatus with cotton-wool soaked in cocaine, or, in several instances, 10 per cent. argyrol. The instantaneous relief from the tightness and wheezing, which was experienced directly the argyrol "pack" was placed in position, was extremely striking: further, following a single pack, the relief often lasted for days and even weeks without further treatment. Additional evidence for the nasal origin of many attacks has been afforded by short-wave therapy. Throughout this series short-wave therapy has been confined to the nose in the majority of the cases, since it was early found that little, if any, response followed treatment of the chest itself. It has, nevertheless, been a frequent experience since the rotating electrode was used, for an asthmatic attack to cease almost immediately when the current was switched on. When this effect was first noted, three previously untreated cases were given nasal therapy with the short-wave current as the only form of treatment. In all three cases there was complete cessation of attacks and in one, a woman aged 53, with a three-month history of nocturnal wheezing and tightness terminated by expectoration, there has been no further attack in the three months since the last treatment was given. The other two cases were of considerable severity and full treatment was started as soon as the course of short-wave therapy had been completed. This was done because previous experiences of asthma had shown that, although immediate relief from conservative nasal therapy usually occurs, it is unlikely for this to be permanent without treatment of the remaining factors.

PATHOLOGY OF THE NASAL LESIONS

The various nasal lesions have been fully described by Hazeltine (5), and James (6). In a series of 125 cases James found the following :

No changes	10 per cent.
Deflected septum	30 ,, ,,
Sinusitis-suppurative	9 ,, ,,
Sinusitis-catarrhal	18 ,, ,,
Polypi	10 ,, ,,
Oedematous turbinals	85 ,, ,,
Vasomotor rhinitis	10 ,, ,,

In the present series the percentage of cases with suppurative nasal lesions is rather higher, but it should be pointed out that the series is largely drawn from a district where nasal catarrh is regarded as part of normal life.

The reflex path from the " trigger " area to the bronchi has already been considered. The spontaneous initiation of the reflex is probably largely affected by variations in the degree of contact between the middle turbinal and the septum. In the majority of cases of asthma, anterior rhinoscopy reveals one or both of the middle turbinals to be œdematous and moulded against the septum. Increase of this swelling can easily be seen if the patient is examined during a spasm, and many patients find that sudden nasal obstruction is the first warning of an imminent attack.

There are several clinical observations pointing to an association between the nose and asthma which cannot be fully accounted for by this reflex mechanism alone.

Hazeltine has repeatedly stated that sensitization to foreign proteins is secondary to the nasal factor and disappears when the latter is removed. Although no mechanism has yet been demonstrated, the observation is certainly true. Repeated examples have been encountered in the present series of cases in which a definite sensitization has vanished when the nasal treatment was started. The relationship is occasionally noticed by the patient, apart from the results of treatment as in the following case.

In a farmer with asthma of four years' standing it was found that an attack was brought on by drinking cow's milk, eating onions or milking a cow. He states, however, that this only happened when he had a cold in the head. Without a cold, he could drink milk, eat onions and milk cows with impunity. The " colds " in question were typical attacks of true coryza, and bore no relationship to vasomotor rhinitis. The latter condition was further excluded by nasal smears during an attack. Numerous polymorrhonuclear leucocytes and streptococci were present, but no eosinophils could be demonstrated. This patient was first seen in August, 1937. One month after starting treatment he was free of asthma, and there has been no recurrence since. During this period he has had two head colds.

During recent years the tendency has been to regard the nasal lesions found in asthma as secondary to allergy, and to rate the importance of the nose in the ætiology of the disease at a very much lower level than had been done previously. Such a view is certainly supported by the results of nasal surgery in the asthmatic. Lintz[7] has deplored the fact that over 30 per cent. of asthmatics are subjected to nasal surgery without relief. During the last 10 years there have been few advocates for nasal surgery in asthma, and the nasal factor has become more and more neglected. The disappointment which followed surgical intervention was, on the other hand, due to the fact that the scars which are left after turbinectomy, etc., will act as " triggers " for the reflex, often to the same extent as did the original disease. This point has been emphasized by Hazeltine[6]. "Certainly, among the cases reported here, the most refractory have been those in which extensive nasal operations had been carried out in the past. In one such patient the numerous adhesions and scar tissue which occupied both ethmoidal regions could easily be shown to be triggers for the reflex by even the

lightest touch with an exploratory probe. In this particular patient, the reflex could still be elicited after thorough cocainization.

It is not meant to infer that allergy plays no part in the production of the nasal lesions. Allergic œdema of the mucosa must seriously interfere with the ventilation and drainage of the upper nose and in this way help to perpetuate infection of the posterior cells. The results, however, of conservative treatment form very convincing proof that infection is the primary factor and, when occurring in pre-disposed subjects, may lead to allergic manifestations.

DESCRIPTION OF TREATMENT EMPLOYED IN THE PRESENT SERIES OF CASES

With a few minor modifications, the general plan of treatment given in the original publications [3] was followed. If we take the points for therapeutic attack as (1) allergy, (2) the nasal factor, and (3) the digestive factor, the treatment may be conveniently summarized under these headings.

Direct treatment of allergy was confined to the following routine:

(a) *Avoidance of common allergens.*—Each patient was instructed to remove all articles containing feathers or hair from the bedroom. In this connection it is of interest that the majority of the patients said that this had already been done. Under cross-examination, however, all but one patient was found to have retained an eider-down, although pillows and mattress had been replaced with Kapok or similar material. In a few cases, the patient's pillow had been changed, but not that of the husband (or wife). When instructing patients in the hygiene of the bedroom, it is important, therefore, to give careful and detailed explanations.

(b) *Medicinal.*—Every patient received the following calcium chloride mixture: calcium chloride, gr. 15; sol. pectin [apple pectin(, 100 grade), gr. 87½; glycerine chlorbutol(, 1 in 12), ½ fl. oz.; distilled water to 20 fl. oz.] 1 per cent., m. 120; syrup simplex, min. 30; water to ½oz. with a sufficient dose of tincture of belladonna added to produce slight but definite dryness of the mouth. This dose is found by trial, but for the average adult seems fairly consistently in the region of 15 minims. Three doses of the mixture are taken each day. Cases with nocturnal attacks are advised to reserve their third dose for bedtime. This mixture should be regarded as an indispensable part of the treatment. Its effectiveness is increased by the addition of a vitamin D preparation to the daily régime.

No form of desensitization has been found necessary among the patients comprising this series, and fæcal vaccine has not been employed.

It is convenient here to note the use of "epicaffneine" [ephedrine hydrochlor, gr. ½; caffeine sodium iodide, gr. 5; sodium iodide, gr. 5; dilute hydriodic acid, min. 5; decoction of caffeine (3 oz. to ½ pint), min. 40; water to 1 oz.], for the relief of actual attacks. The patient is told to take one drachm, or less, immediately "tightness" is felt. This should completely obviate the use of adrenaline.

Treatment of the Digestive Factor

The part played by digestive defects in the pathogenesis of asthma will be fully considered in a separate communication. The importance of treating the digestion cannot be over-emphasized. In the series under review, 89 per cent. of the cases gave a history of flatulent dyspepsia. In every case where dyspepsia is present the "low-fat" diet[3] is adopted. The main points in this diet are the rigid exclusion of milk and milk products, with the exception of butter, and the avoidance of fats both in foods and in cooking.

A full description of the rationale of this diet is given by A. T. Todd[4]. Briefly, the foods to be strictly avoided are :

Fat meat; pig's flesh in any form, e.g., sausage, bacon, ham, duck, goose, pigeon, sardines, anchovies, salmon, lobster, herrings, mackerel; milk, cream, cheese, cocoa, chocolate, pastry, rich cakes, pâté de foie gras, dumplings, mayonnaise, salad oils; parsnips, dry peas, dry beans, nuts.

It is always necessary to emphasize that the veto on milk is absolute. Patients are liable to start taking milk in their tea, and many unaccountable relapses have been traced to this cause.

There are two preparations of milk which are allowed for cooking purposes and for tea. They are Nestlé's Sweetened Condensed milk and Allergilac (Cow and Gate). The Nestlé's product is the more generally useful, but it must be the sweetened variety.

Some preparation containing vitamins A and D is an essential addition to this diet.

It is absolutely necessary to insist that inhalation of tobacco smoke is stopped, and smoking must be strictly prohibited.

Treatment of the Nasal Factor

(a) *The Argyrol Pack*.—Prior to the adoption of short-wave therapy the mainstay in the treatment of the nasal factor was the "Dowling" or "ethmoid" pack. Briefly this consists in lightly packing the superior meatus, from the spheno-ethmoidal recess to the anterior border of the middle turbinal, with tampons of cotton-wool soaked in 10 per cent. argyrol. The pack is left in position for an hour and is then extracted. A full description of the technique has been given by James[6].

A routine "course" of treatment consisted in three or four of these packs, carried out on successive days. At least three of these courses were necessary during the first year of treatment.

Each course should be limited to four packs, or the mucosa becomes very irritable and more harm than good will result. For the same reason the minimum interval between courses must be at least 6 to 8 weeks.

If the best results are to be obtained, it is essential that the treatment is carried out on *successive* days.

The beneficial effect of the pack is due to the specific effect of argyrol on the nasal mucous membrane. When a 10 per cent. solution is brought into intimate contact with an infected mucosa, it is very rapidly absorbed. An outpouring of viscid mucus, often accompanied by long "stringy" pieces, follows within a few minutes. By packing the superior meatus, deturgescence of the mucosal covering of the middle turbinal results, and the pathological contact of turbinal and septum is stopped; this, in its turn, restores, more or less, to normal the ventilation and drainage of the posterior group of sinuses.

In addition to the course of packs, and as part of the daily toilet, the patient is instructed to spray the nose with an oily chloretone nebulant. This should be used for a full two minutes morning and evening.

In the majority of cases, with a co-operating patient, the results of this treatment, are extremely good. It has, however, some drawbacks which are liable to prove rather troublesome. The technique of the pack is by no means easy, and a good deal of practice is necessary before efficiency is attained. Unless carried out by an expert, it is often painful for the patient, and even with perfect technique, it is a very uncomfortable experience.

Apart from consideration for the patient, this is a serious drawback since it makes the treatment of children an extremely difficult problem.

As the ideal conservative treatment it fails in one major respect. About one in every 6 asthmatics presents a sufficient degree of septal deflection to make it impossible to insert the pack until a septal resection has been done; a further mechanical difficulty may be met with in the shape of adhesions between the middle turbinal and the septum which again interferes with access to the spheno-ethmoidal recess.

A final trouble with the pack is the inconvenience entailed, particularly in hospital practice, in arranging to carry out treatment on consecutive days.

It was these defects in the treatment which led to the trial of short-wave therapy as a possible substitute for the pack.

SHORT-WAVE THERAPY

With the first technique employed, the results offered little promise that the therapy could ever supersede the pack. It was found, however, to be a definite advance in two directions.

In the first place, if short-wave therapy was started immediately after a course of packs, the value of the latter seemed considerably enhanced, and the interval before repetition became necessary appeared to be greatly prolonged. Most cases of asthma became completely free from attacks at a very much earlier date than had been usual with packs alone.

Secondly, short-wave treatment was found to be rapidly effective in the treatment of acute coryza. Prior to the use of short-wave therapy, even when improvement was well established, relapses were liable to occur during the first two years of treatment. If relapses due to indiscretions on the part of the patient are excluded, nearly 100 per cent. of the remainder are attributable to a "flare-up" of the nasal infection. These "flare-ups" usually start as a simple acute coryza, but the onset may be insidious. Without an adequate method of treatment, an epidemic of the so-called "influenzal cold" is liable to produce a disappointing crop of relapses among patients who were previously getting on well. Every patient is now instructed to report for short-wave treatment at the first sign of a head cold or of any nasal symptoms. Provided treatment is given within 48 hours of onset, the vast majority of head colds are banished in 24 hours. Even if treatment is delayed and asthma has already developed, the latter is usually stopped within four or five days.

There are always a few patients (not necessarily asthmatics) having treatment for an attack of acute coryza, but during the winter months, minor epidemics periodically occur and batches of cases continually present themselves.

The interesting point has been noticed that each epidemic may differ in its response to short-wave therapy. Fortunately, most respond well and two treatments suffice for cure, but one epidemic which occurred at the end of 1937 could not be influenced at all. Although this has not occurred again, subsequent epidemics have varied in the number of treatments necessary to clear the condition completely.

During the earlier work, the value of short-wave therapy became increasingly apparent as the technique was gradually improved. The action of the short-wave current on an infected nasal mucosa has formed the subject of careful study from the clinical and pathological standpoint. A full account of the findings will be published at a later date, but it is necessary to point out here that its action is not the same as that of argyrol. I tentatively suggest that their respective actions may be conveniently described as follows:

Argyrol causes deturgescence of a mucosa in which the mucous glands are distended with secretion. The resulting subsidence of swelling restores drainage where this has been stagnant.

Short-wave therapy has a different action which appears at least to be three-fold:

(1) It inhibits the activity of bacteria. (2) It stimulates the body's defensive processes, and (3) it quickly causes shrinkage of a swollen mucosa, particularly if this swelling is allergic in origin. Here its action differs from that of argyrol. If the mucosa is "choked" with mucus, short-wave therapy is of little help and argyrol must first be used.

This difference in action appeared to explain why the combination of the ethmoid pack and short-wave therapy gave much more satisfactory results than either treatment alone. Their actions would seem to be complementary.

The Rotating Electrode

The next step in improving the treatment came with the introduction of the rotating electrode. The clinical differences between a stationary and a rotating electrode have previously been described[1] [2]. It was now found that the ethmoid pack could be replaced by simple spraying of the nose with argyrol. A trial of spraying on previous occasions had never been very encouraging but when it was carried out simultaneously with treatment with a revolving electrode, the results were very satisfactory.

A routine was quickly evolved which has now given consistently good results in well over 100 cases of varying degrees of nasal sepsis. It is a testimony to the value of short-wave therapy that, at the beginning of the investigation, the first flush of enthusiasm for a new treatment was conspicuous by its absence, but that, after treating over 300 cases of nasal infection, it has become established as the main treatment for the condition.

Technique of Treatment by the Rotating Electrode

A brief description of the rotating electrode was given in the first paper. Further experience, however, has led to some modifications in the design.

The following arrangement has been in continual use for a considerable time and has given reliable and satisfactory results. The standard "arms" designed to hold Schliephake glass-shoe electrodes are essential for the device in its present form.

The motive power originates in a $\frac{1}{6}$ of a horse-power electrical fan motor, which is attached to the flange of the arm close to the actual machine. At a point half-way up the arm, an ebonite block is screwed to the under-surface of the arm. Into each side of the block a ball race is pressed and a metal rod traverses the block so that it can turn freely in the ball races. On to each end of this rod is attached an ebonite pulley wheel. An elastic band connects the motor to one of these wheels. The diameter of the pulley wheel on the motor is $\frac{1}{4}$ in., and that of the wheel on the ebonite block is 2.8ins. in diameter. No modifications in the electrode itself have been adopted since the publication of the first paper. The diameter of the wheel on the end of the shaft of the electrode is 4ins., and this is connected to the shaft in the ebonite block either by elastic or cord.

The flex to the motor is incorporated into the same switch as the machine itself, so that, when the machine is switched on, the electrode automatically rotates without further manipulation. If desired a separate switch can be put into the flex to the motor, so that the motor can be turned off, if the rotating electrode is not being used.

As regards the arms, there are two disadvantages with this arrangement. In the first place the use of the universal joint at the end of the arm is very restricted, since it is no longer possible to move this without interfering with the pulley-wheel connections. In the second place, if it is desired to utilize the telescopic property of the arm, it is necessary to employ different lengths of connecting bands for differences in the total length of the arm, since the band, even when elastic, cannot be stretched very far if even rotation is to be obtained.

As previously described, both sides of the nose are treated simultaneously. The

rotating electrode, approximately 5 cm. in diameter, is placed with the centre of rotation opposite the upper nose, and an 8.5 cm. electrode is placed at the back of the head (see figs. 1 and 2), and the position of the rotating electrode is chosen so that, during each cycle of rotation, it will have covered the areas occupied by the frontals, ethmoids and antra. Both eyes are unavoidably radiated as well, but there has never appeared to be the slightest harmful effect as a result. It has, in addition, been noticed that lacrimation, which was a fairly common occurrence with a stationary electrode, is rare with the new method.



Fig. 1. Front view of electrode, showing pulley wheels and motor.



Fig. 2. Lateral view showing electrode. Rotating electrode is 1½ cm. from the nasal bridge.

The patient is seated in a comfortable chair, facing the arm of the machine which carries the rotating electrode. Owing to the restriction of movement which the present arrangement entails in the universal and " telescopic " joints of this arm, much trouble is saved by putting this electrode in position first. This is easily done and the wider range of movement of the arm carrying the back electrode allows it to be put in the position demanded by the size and shape of the patient.

Method of Applying the Rotating Electrode

The pulley-wheel device works much more satisfactorily if the glass shoe of the rotating electrode is maintained in the vertical plane, and the patient's head moved so that the external nose is approximately parallel to it. As already mentioned, the centre of rotation of the electrode is placed at a level just below the junction of the nose and forehead. The patient is not permitted to touch the glass shoe of the " active " electrode, for reasons fully dealt with in the second paper. He is instructed to maintain a position just short of touching the glass. The total air space between the electrode and the skin over the nasal bridge is 1½ cm.

Method of Applying the Posterior Electrode

This is placed as nearly as possible parallel to the front electrode, and in such a position that the patient feels no sensation of warmth at the back of the head. The object is for the patient not to be conscious of any heating effects from the posterior electrode. There are two ways in which this can be avoided. In the first place, the air space should be at least 2½ cm. Secondly, if heat is still felt with this gap, the electrode is moved to a higher position where it will be further from the excellent

conducting path offered by the upper neck muscles. Contact with the glass shoe of this electrode is encouraged on account of its steadying effect on the patient, provided that the preceding precautions have been taken to avoid unnecessary losses into the neck muscles.

In a previous paper[3], we described the way in which the needle of the tuning meter in the patient's circuit tends to " flicker " during each cycle owing to variations in capacity during the excursion of the rotating electrode. If the " J " meter is watched carefully while the tuning knob is turned, it will be found that two resonance points often exist. In one case the reading is a maximum when the electrode is opposite the forehead and in the other when it is opposite the tip of the nose. The former is obviously the optimum position of tuning. It is difficult to look at the " J " meter and at the electrode at the same time. This can be obviated by holding a neon light over the centre of the shaft of the rotating electrode since it is quite easy to watch this and the electrode simultaneously (the neon light can be attached to the electrode at the front or behind, since the brilliance of its lighting varies with alterations to the " J " reading). If the " J " reading is employed alone, a rectified meter is essential, since the unrectified meter lags too far behind.

One or two minor points of technique are worth noting. It is frequently forgotten that the leads from the machine to the patient will act as "electrodes" if they are too close to him. A common mistake is for the leads to be allowed to touch the patient, leading to increase in the circuit losses and upsetting the tuning. The whole arrangement of the patient in relationship to the electrode system should be such that the leads are kept at as great a distance as possible from any part of the patient's body.

In the majority of chronic cases, treatment has been given three times a week and a total of twelve treatments represents a "standard" course. While a final decision has not yet been reached, my impression is that treatment on alternate days gives better results than daily treatment. With regard to dosage, it is best to start with a dosage of ten minutes and to keep the output of the machine well within the limits of the patient's tolerance. If no reaction occurs, this time can be increased to twenty minutes by the fourth treatment. At the same time the valve-filament voltage is increased at each sitting until the highest output possible is reached. If, during treatment, signs of intolerance appear, such as headache, dizziness or "bursting" sensations, the current should be switched off at once and a minute or two allowed to elapse before restarting. When this occurs in a patient, it is found that it can be avoided if the treatment is started with a weak current and gradual increase is made after the first three or four minutes.

In treating acute coryza the method is different. It is found that a short period of seven to ten minutes, with a comparatively low output so that the patient is only just conscious that any heating effect is present, gives infinitely better results.

These descriptions of the dosage are necessarily very incomplete. If, however, the sizes specified for the electrodes and the air gaps is carefully maintained, the patient's sensations seem to be a fair indication of the relative dosage being given.

The Argyrol Spray

The patient is told to spray the nose with a 10 per cent. solution of argyrol for a full fifteen minutes each morning during the first week of the short-wave treatment. The spraying usually produces a large quantity of viscid mucus, and is best carried out with the head over a basin. The procedure in the evening is different. The patient lies with the head back over the side of a bed or couch and about thirty minims are instilled into each nostril. The argyrol solution should be not less than twenty-four hours and not more than one month old.

Argyrol should be used for one week in every month. For the remaining three weeks the oily chlorbutol nebulant (chlorbutol, gr. 5; menthol, gr. 12; camphor, gr. 12;

oil of cinnamon, min. 1; liquid paraffin to 1 oz.) is used for two minutes morning and evening.

This is the routine employed at present. So far 40 new cases of asthma have been treated since the rotating electrode was adopted. A further 43, who had previously been treated by the pack and the stationary electrode, have been re-treated with the new routine. Among the former group of 40 cases, resection of the septum has not so far proved necessary.

In at least four of this number, there was a sufficient degree of deviation of the septum to have rendered a pack impossible. All cases have done well, although further observation will be necessary to be certain that the results can be maintained.

In the second group, at the time the new treatment was started, there were three cases in whom septal resection was contemplated because improvement had not been satisfactory. Since treatment with the rotating electrode each case has done well.

With the old method of treatment, lavage of infected antra had always been carried out. This procedure has not so far proved necessary with the new routine.

It is not possible to estimate the number of infected antra which would previously have required this treatment, since radiography and transillumination are so untrustworthy. In 7 of these cases, there was strong clinical and X-ray evidence that gross antral infection was present. After completing treatment, discharge was quite dried up, and no evidence of infection remained. No alteration in technique was made to deal more directly with the antrum.

Polypi, on the other hand, seem almost a contra-indication and their removal is always carried out before treatment is started. However, a noteworthy feature of polypoid cases (including the whole series of 303 nasal cases), is the invariable return of smell, however long this has been lost. (In one case this was only partial, but a grossly deflected septum prevented removal of most of the larger polypi.)

RESULTS OF COMBINED TREATMENT OF ASTHMA

The full series of cases comprised 30 men, 31 women, and 16 children. There is no satisfactory classification whereby the severity, duration or frequency of attacks can be taken into account in expressing the results. In the classification adopted here, the results in each case are divided into good, fair, poor and nil. A good result connotes any patient who has become free from symptoms and remained so, or a patient who was incapacitated by severe asthma and who has either become completely free or whose attacks have become sufficiently easily controlled for them not to be any longer distressing, or to cause inconvenience. A fair result connotes a patient who, while not getting incapacitating attacks, continues to get attacks causing inconvenience or distress.

Cases in which the degree of improvement does not warrant inclusion in the above two groups, are placed in the " poor " group.

If the total number of cases is considered as a whole, the results are seen in the following table:

	Total.	%		Total	%
Complete freedom or considerable improvement	76	91.5	Good	63	76
			Fair	13	15.5
Poor or nil	7	8.5	Poor	4	4.8
			Nil	3	3.6

As was stated earlier, 43 of these cases have been observed for over a year, and none for less than two months. Actually, the results have shown unmistakable im-

provement with the new method, and there is every reason to believe that, with the full treatment described by A. T. Todd, complete control of the disease will be obtained in over 90 per cent. of cases. Further publications on the subject, as indicated in the present paper, will be forthcoming, and the figures given above can be confirmed after a further period of observation of the same series.

Direct comparison of results with rotating and stationary electrodes can be seen in the following table :

	Stationary Electrode. Total, 26 cases.		Rotating Electrode. Total, 41.	
	Number.	Per-centage.	Number.	Per-centage.
Good	14	53.8	36	87.8
Fair	8	30.8	2	4.9
Poor	2	7.7	2	4.9
Nil	2	7.7	1	2.5

These two groups were selected as those cases who had received treatment only with either the stationary or rotating electrode. It should be pointed out that, in the stationary-electrode group, all cases had received packs immediately before the short-wave therapy. Two had had septal resections and two antral lavage. The only nasal procedure, except the argyrol spray, in the rotating-electrode group had been the snaring of polypi in two of the cases.

REFERENCES.

(1) STOCK, J. P. P. *Brit. Jour. Phys. Med.*, 1938, Vol. 1, New Series, p. 196.
(2) STOCK, J. P. P., and BURCH, C. R. *Brit. Jour. Phys. Med.*, 1938, Vol. 1, New Series, p. 246.
(3) TODD, A. T. *Practitioner*, 1933, cxxxi, 168.
(4) TODD, A. T. " Treatment of Some Chronic and Incurable Diseases." 1937 : John Wright & Sons, Bristol.
(5) HAZELTINE, BURTON, *et al. Med. Jour. and Record*, 1929, Nov. 6th and 20th.
(6) JAMES, J. ANGELL. *Practitioner*, 1933, cxxx, 183.
(7) LINZ. *Jour. Am. Med. Assocn.*, 1925, 85, 378.

THE SOCIETY OF PHYSIOTHERAPISTS

Post-Graduate Lectures

The question of holding post-graduate lectures for members had the attention of the Executive Committee at their meeting on 8th February. Following upon the publication, in the *British Journal of Physical Medicine*, of the Society's proposal to hold such lectures if sufficient support was forthcoming from members, the Committee received several letters, but the response has not been as good as was anticipated. It was agreed, however, to proceed with the holding of post-graduate lectures on a small scale. Arrangements are being proceeded with, and details will be circulated to all London members. The Committee hopes that fuller support will be forthcoming when definite details are available, and that London members will make a point of attending if it is possible for them to do so. The Committee also decided that such lectures would be the means of bringing members together more often for social intercourse, and it was suggested that, following the lectures, some definite time should be given for this purpose. As previously stated, London members will be given full particulars of the lectures when such are available, but provincial members wishing for particulars are asked to be good enough to advise the Hon. Secretary accordingly.

1939/40 Subscriptions

The Committee wishes to remind members that their 1939-40 subscriptions will become due at the end of March, and that it will save expense and clerical work if members will remit their subscriptions promptly following the receipt of the renewal notices which will be forwarded to them early in March.

PSYCHOLOGICAL FACTORS IN PHYSIOTHERAPY*

By H. CRICHTON-MILLER, M.A., M.D., M.R.C.P.

THERE are few diseases that are caused solely by psychological factors. There are fewer still into which psychological factors do not enter. One might almost say "none," because every patient has an emotional attitude to disability. We assume that every patient who complains of a symptom wishes to recover from it. In the war we realized that this was not the case. From that great awakening we have been slowly and rather reluctantly recognizing that, as in war, so in peace-time, a patient may have one of three attitudes to a symptom.

(1) He may whole-heartedly desire to be cured of it—the wish to be well.

(2) He may consciously desire it to persist—the wish to be ill—i.e., malingering.

(3) He may consciously desire cure and unconsciously long for the persistence of his symptom. This is the compromise attitude.

My hope is that I may succeed in convincing you that such an attitude of compromise is far commoner than is usually supposed. All doctors—or nearly all—recognize the difference between the patient who possesses the will to be well and the patient who is possessed by the will to be ill. But even this broad distinction sometimes eludes us. Fifty years ago the syndrome of railway-spine was recognized as a particular symptom-complex, in which the effects of concussion were exaggerated by self-pity, and the will to be well eclipsed by the hope of compensation. About that time a wise physician said of the hysterical girl—"It is not that she cannot; it is not that she will not; it is that she cannot will." During this half-century further changes in society and the law have resulted in an increased measure of confusion between these two attitudes. Of these changes the Workmen's Compensation Act, National Health Insurance, and pensions for war disability are the chief. This much is all very obvious, but there are two fallacies that must be avoided. The first is to imagine that the will to be ill is always a form of conscious deception, or in other words, that the will to be ill can be equated with malingering. As I have already suggested, there are many patients who consciously and sincerely believe that they are anxious to be cured, whereas unconsciously they cling to their disability with a tenacity that defeats all ordinary therapeutic efforts. This is a very large class. It comprises a high proportion of our chronic cases, and it is a class that the evolution of society is fostering in ways that seem as regrettable as they are inevitable.

The other fallacy that we must avoid is to suppose that the will to be ill is always based on rational considerations. Both the patient and the doctor are liable to be persuaded by appearances. It is said of this type, "After all he has nothing to gain and everything to lose by clinging to his disability." To all outward appearances such a statement may be true, and much delicate investigation may be required to reveal the buried subjective motives that neutralize the will to be well. Of these I may mention as the more usual, self-punishment, self-importance, revenge and various forms of protest. I shall deal with them in greater detail later on.

* A paper read at the meeting of the Physical Medicine Section of the Royal Society of Medicine, November 18th, 1938.

Psychological Difficulties Relating to Physiotherapy

All that I have said so far is applicable in a general way to every form of treatment. But physiotherapy has its own particular difficulties just as psychotherapy has specific problems. For the most part the difficulties encountered in the patient's resistance to cure are totally different in your field from what they are in mine. There is, however, one obstacle common to both departments, namely that our treatments tend to be lengthy and expensive. Perhaps you have thought of these two factors in relation to the patients who are anxious to get well and are discouraged from undergoing physiotherapy on account of the length of treatment or its cost. But what about the patients who are out for the longest possible treatment? It has no doubt occurred to you that there are uncured patients who pursue an apparently interminable course of psychotherapy from motives other than the desire for cure. If this thought has not occurred to you, I can only say that you are more high-minded than most of our colleagues. Perhaps it has occurred to you that the patient whose fibrositis is so resistant to your treatment is for some obscure reason glad to continue his or her visits to you. I venture to quote a case I have set forth elsewhere.

A well-known and brilliant woman in the early forties, unmarried, suffered from insomnia. A masseuse was called in who happened to be not only a very skilful masseuse but also a woman of remarkable charm. The massage acted like magic. Several attempts were made to give it up, but on each occasion the insomnia re-asserted itself. At the end of three years the worthy and conscientious masseuse was saying: "I don't know where I shall go for my holiday—you see, I have promised my patient that I shall go wherever she goes. It's most unfortunate, but the poor creature simply can't sleep without massage, and every time she has tried another masseuse during my holidays it has been a failure."

That is an example of the class of case to which I am referring. It is clear that the will to sleep was present, but not the will to be rid of the masseuse, that the unconscious gratification derived from treatment was stronger than the conscious desire, and that that gratification depended not merely on the physical and sensory side of the experience, but also on the psychological and emotional factors. Hence treatment was indefinitely protracted.

"But," you may object, "even granting such a possibility, surely the cost of treatment always acts as a deterrent and promotes rapid cure rather than long treatments?" To that I reply that in general it may be so, but are you always paid by the patient? Can you think of that discontented menopausal wife of an affluent stockbroker who is so convinced that only ultra-violet treatment cures her neuralgia? Are you so flattered by her faithful attendance that you cannot recognize the hidden satisfaction which the patient derives from exacting tribute, in the shape of your fees, from the neglectful spouse? We who practise psychological medicine are forced to recognize the payment factor in most of our cases. We find that a situation such as I have just outlined constitutes an impossible barrier to progress. Let me urge you to remember that there are patients—some, if not many—who are coming to you for the very reason that your treatment costs so much more than a bottle of medicine at the chemist's.

But having said so much, I think I have said all about the difficulties that are common to your department and mine. For the rest we are not troubled with most of your problems. And the first of these is physical pain. I am quite aware that few, if any, of you have recourse to physiotherapy on a penal basis. Nevertheless, it is sometimes practised. I remember vividly when I was a house physician being instructed by my chief—an otherwise good and skilful chief—to treat a hysterical girl with progressive applications of faradism on a frankly punitive basis. But the following case shows the dangers of any such procedure.

The patient was a woman of about 40, who, at the age of five had had an experience which conditioned her sex reactions to physical pain. She married a powerful man of pronounced sadistic tendencies. He died when she was 35. She developed lumbago of a mysterious character. The

physician who treated her in hospital made up his mind that the condition was hysterical. He applied the most painful electrical treatment he could devise. The patient was discharged uncured—or at any rate admitting no improvement. She came later under my care and in analysis her masochistic personality was laid bare. It transpired that the electrical treatment had all along served as a sex stimulant. She described the way in which she would lie awake at night and conjure up the feelings of delicious torture in order to induce a sexual response.

The moral of this story is, I believe, important for all doctors who practise physical therapy—and indeed for most of the profession. It is this. Whenever a treatment induces pain, no matter how necessary that treatment may be nor how inevitable the pain, remember that you may be dealing with a patient for whom torture has a hidden and morbid fascination. And remember also that these patients, especially the female ones, may appear to you to be very ordinary members of society exhibiting no very clear sign of abnormality.

But the problem of the patient's attitude to suffering is not confined to the masochist class who derive enjoyment from therapeutic pain. There are the common groups that enjoy a painful symptom and to whom cure represents an unwelcome discontinuance of pain. Chief among these are the hypochondriacs. The essence of hypochondria, as we now regard it, is compulsive expiation. The sin that originates the trouble is sometimes recognized partially but more often not. Frequently it is transferred, that is to say a recent and clearly remembered misdeed of an unimportant character is used as the peg on which to hang a mass of guilty feeling attributable to some sin of childhood. That original sin may have been of thought (i.e. fantasy) or of deed, but what matters is that it has been forgotten. The result of this situation is that the hyponchondriac goes to his doctor complaining, say, of pruritus. He explains that, on account of the pruritus, his sleep is disturbed. He may or may not mention at first an unfortunate little omission that occurred in his last income tax return. After some weeks of disappointment with a variety of local applications, it becomes necessary to prescribe a hypnotic which is partly successful. By this time everyone concerned is persuaded that the ætiological sequence is allergy—pruritus—insomnia—worry over a trivial act of negligence. But this sequence contains two fallacies. The first is that the pruritus is not merely the result of an allergic condition but in this patient serves a purpose. When the doctor sends him to one of you and the usual electrical treatment fails, you and the doctor begin to agree that the fact of the matter is that the patient is a hypochondriac. To me that means that the pruritus is serving a self-punitive purpose. The other fallacy is that the self-reproach about the income tax is the real cause of the worry. But the doctor has repeatedly assured the patient that the matter is negligible yet he continues to be obsessed by it. In other words, the absolution fails to alleviate the self-reproach. And here, if the family physician is more psychologically minded than most general practitioners, he may realize that there is something deeper down, below the surface of consciousness, requiring the absolution that is being offered for the income tax incident. Thus we get a completely different aetiological sequence which we may formulate as repressed guilt from childhood calling for absolution or expiation; this makes any form of suffering (such as pruritus and insomnia) welcome. Nevertheless, the patient is unconsciously striving to get rid of the guilt which no amount of expiatory suffering appears to eliminate. Hence he is apt to seek absolution for a misdeed in consciousness, since the original misdeed has long been repressed.

Thus we have the complete picture of the incurable hypochondriac. His pruritus yields to no form of treatment, because it is serving a hidden purpose. His insomnia is intractable, both because the pruritus is uncured, and because he continues to worry. His self-reproach is unaffected by reassurance, because it is not the real source of his guilty feelings. You may think all this very far-fetched. Let me beg you, however, to remember this clinical sketch next time you have a really intractable case that you are inclined to describe as hypochondriacal. I do not say all this in any spirit of

derogation of physiotherapy, but merely in the hope that, now and again, when you fail to cure a complaint which you generally consider amenable, you may pause to speculate on hidden reasons for this surprising resistance to your treatment.

An analogy occurs to me from rhinology. Until a few years ago the treatment of nasal and sinus infection was based upon relatively simple conceptions of "cleaning up" the affected parts, whether by local applications or by surgery. To-day, the chief aim of the rhinologist is to conserve and promote ciliary activity. In other words, an unseen factor has been recognized which is more persistent and in the end more potent than the factors directly observed. Furthermore, I trust that a remembrance of the case quoted above may occasionally save you from unnecessary feelings of therapeutic inadequacy.

But let me turn to another aspect of your work. We are all familiar with the class of patient who is confronted by scepticism. That scepticism may be on the part of his family or on that of his doctor or both. These are the patients whose primary and quite conscious quest is vindication. They rejoice when a surgeon finds that an operation is indicated; they exult when they are ordered to go abroad; they are even satisfied by the charlatan who finds "a rare germ." When patients of this type come to you, the inevitably spectacular character of some of your treatment gives them the comfortable feeling that their complaints have been vindicated, their family's scepticism refuted, and their family doctor shown-up for the back-number they always thought him to be. Remember then that the popularity of your treatment with your patients may sometimes be based on considerations of this sort, and depend more on prestige and importance than on actual therapeutic validity.

A somewhat similar type confronts us in the patient who cannot stoop to accept simple explanations nor to follow simple advice. For instance, there is the patient who suffers from mild fibrositis arising from intestinal stasis. The honest family doctor has rightly diagnozed and suitably prescribed. But the aperients never suit the patient and the diet is unpalatable. Presently the helpful neighbour persuades the patient to consult her wonderful osteopath. Then something really happens and that evening the patient entertains her husband by a description of the interview. "He said it was due to one of my vertebræ being out of place, and he put it back with a fearful click. He says he will get my rheumatism perfectly cured in twelve treatments, but that it's a great pity I didn't go to him a year ago. I wish I had. I always knew there was something more wrong with me than merely constipation." Here you see that the osteopath has done a world of good to the patient's discontent. He has shown her that she is an interesting case and not merely an unco-operative and constipated woman. Furthermore, he has proved that she has been the victim of her doctor's ineptitude instead of her own stupidity. Now I know that manipulative treatment can effect remarkable cures in certain cases, but I beg you to remember that a certain proportion of your patients come to you in such a spirit as I have described. The measure of good you do to them is likely to be the measure of their suggestibility and not of your professional skill.

A very large group of patients is almost identical with the one I have just described, and, indeed, overlaps it to a considerable extent. I refer to the seekers after Christian Science, New Thought and Spiritual Healing. Their principal quest is a cure by magic. Please do not misunderstand me. The cures of faith healing in all its forms, orthodox and heterodox, home-grown and imported, do not all partake of magic; many of them are analogous to good psychotherapy. But what I do say is that the patients attracted to such forms of cure are those who crave for that form of superiority which is associated with initiation into any obscurantist group. Magic and obscurantism are, of course, closely allied. The magic of the displaced vertebra is very similar to the magic of learning that all one's suffering has been a false claim. At any rate the people who pursue the one are often found pursuing the other at a subsequent date.

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PHYSIOTHERAPY and ORTHOPAEDICS

PART III

BY W. SAYLE CREER, M.CH. (ORTH.), F.R.C.S.

NERVE AND MUSCLE AFFECTIONS

MORE specialized reasons for treatment which may be mentioned here include cases of nerve injuries and other causes of paralysis. In all cases of nerve injury nothing can be done to accelerate the regrowth of the nerve. But both before and after operation the essential is to maintain the muscles in as healthy a state as possible so that, when the nerve has regenerated, they will be ready to react to the nervous impulses. Consequently our patients attend the massage department for many months to receive massage of muscles and joints and electrical stimulation of muscles. Despite this, the muscles will waste, but they will not degenerate, except after a long period.

Under this heading we have another use for one of the branches of physiotherapy, electrical stimulation. We use this to test whether the muscle or the nerve is abnormal. Is the nerve divided completely or incompletely, or is it being irritated by some outside agent? Is the muscle belly diseased or has the tendon been cut? This subject is an immense one, but it is worth touching on a few aspects which do not appear to be well known, despite the fact that they have been in the text-books for a number of years.

One frequently sees the statement that a muscle "does not respond to faradism; responds to galvanism." Now this is unscientific. It is of very little greater value than to say about some article one is offering for sale, "Oh, it costs a few shillings; you can't have it for pence." This statement is self-evident when we consider certain facts about the response of a muscle to electrical stimulation. Any muscle which is still alive will respond to the stimulus of the passage of an electric current provided (*a*) the current is large enough; (*b*) the current passes through the muscle for a sufficient period of time, i.e., the duration of the current is large enough; and (*c*) the rate of change of quantity of current is rapid enough, i.e., if it is found that 10 amps of current are needed the current must rise from zero to 10 amps sufficiently rapidly. In actual practice the make and break of the current is almost instantaneous, which makes the rate of change of current infinity. This third factor can, therefore, be ignored, and all we have to think of is the strength and duration of the current.

The relationship of these two factors is that as long as one is increased the other may be reduced within limits. But there is a minimum strength of current below which an infinity of time of passage (duration) has no effect. We call this the *Rheobase*. Similarly there is a minimum duration. This is most satisfactorily measured by taking a standard current of *twice the rheobase* and finding how small is the shortest duration to which the muscle will respond. This period is called the chronaxia of the muscle.

Individual (healthy) muscles have varying figures for these two factors. The more abnormal a muscle is, the greater they become, but the relative rise is greatest for chronaxia. Consequently a muscle, paralysed because the nerve is cut, requires only a slightly greater strength of current but a much greater duration. The factor which varies most is always the easiest to note and so chronaxia is the best indication of the health of a muscle.

The practical application of these facts is this. Whether galvanism or faradism are used we always exceed the rheobase or minimum current strength by a good margin,

so that the difference in response must have something to do with chronaxia or duration. All methods of giving galvanic stimulation necessarily mean that the duration of the current is long. Naturally even badly paralysed muscles will respond. The duration of current of faradic coils is comparatively short. Therefore, only fairly healthy muscles whose chronaxia is short, can be expected to respond to this form of stimulus. But the unscientific side of the matter is that the duration of current flow in a faradic coil varies at each make and break, varies in different coils, and is not measurable with accuracy. This means that we have no idea how near or how far from normal a muscle is when we say it responds to faradism. In fact it may respond to Miss Smith's faradic coil and not respond to that owned by Miss Jones. The best we can do is always to use the same coil, but even this is inaccurate. There is not space to discuss the matter further, but one can mention that there is an accurate way and that is to use the current obtained from a *condenser machine*. Absolute precision is possible with this. Precision is immaterial as regards treatment, so that no one need rush to discard the faithful Bristow battery in exchange for an expensive and heavy condenser outfit.

In the chronic nerve and muscle diseases, where muscle wasting and weakness is the predominant sign, massage and exercises and electrical treatment will enable the patient to live more comfortably, though there can be no cure. In those cases where inco-ordination is the most marked feature it is often possible to alleviate the patient's clumsiness by re-education exercises, but massage is a waste of time. In states of hypertonicity, massage is detrimental because it increases the already enhanced muscle tone.

The greatest benefit is found in cases of infantile paralysis. As soon as the acute stage has subsided, i.e., when the muscles are losing their tenderness, massage should be commenced in order to reduce the wasting of muscles which will ultimately recover in whole or in part. This treatment is, of course, carried out in conjunction with splintage and needs to be continued for some two or three years, by which time it is likely that maximum recovery has been reached. Recently there has been a great increase in the use of exercises carried out while the patient is lying in warmed water. I shall not dilate on these now.

In those cases of infantile paralysis, or other diseases or injuries where muscle tendon transplantation has been carried out, the patient requires to have his nervous system re-educated in order that the transplanted muscles may perform their new and, at first, strange actions. It is in such cases that the skilled and patient masseuse shines most. No one can replace her. For instance, a very successful operation after injury or paralysis affecting the extensor muscles of the wrist and fingers, is to transplant the flexor carpi radialis into the extensors of the thumb and the flexor carpi ulnaris tendon into the extensor tendons of the fingers. The transplanted tendons have to wind round the radius and ulna bones from the flexor surface to the extensor aspect. In their normal position they act together with the other flexor muscles. In their new position they must relax when the flexors contract and contract when the flexors relax. Despite this complete reversal of habit it does not take the expert masseuse long to make them efficient.

After the first period of splintage and rest, while the new insertion of the tendons becomes strong, massage is given as a general measure. The sluggish muscles are then stimulated to contract by faradism. After a day or two of this the patient is told to try to make the new movement at the same time as the electricity is given. As his eyes watch, and his muscles and joints and skin feel the new movement imparted by the current, his brain is registering new sensations and sending out new impulses through new channels. In a very short period the first flicker of purely voluntary action is seen and from then onwards massage, exercises and faradism are used to increase the speed and power of the muscles.

Similarly tendon transplants in the leg require treatment, but, as the function of

the leg is largely supporting only and as it is seldom that there are sufficiently powerful muscles left to transplant, we tend to rely more on bone and joint operations. The masseuse will seldom be asked to treat the leg.

The last of the muscle conditions to be discussed is Volkmann's ischaemic paralysis, which almost invariably affects the flexor muscles of the forearm and may be met with after fractures and dislocations at or near the elbow. In this distressing complication the muscle fibres die and are replaced by fibrous tissue. More correctly, only the fibrous tissue is left when the fibres die. There is little which can be done for the established condition. In certain cases an early operation may prevent the spread of the condition. More important from our present point of view are those cases which are only mild. My experience is that 80 to 90 per cent. fall into this category.

Clinically one finds that the fingers cannot be extended actively or passively because of pain and tightness of the flexor muscles. Treatment consists of massage to the muscle bellies and splintage for the wrist and fingers. Individual small straight splints are applied to the fingers. The wrist is splinted in as much dorsiflexion as possible. Because the fingers have to be splinted they also must receive daily massage and exercises. Each time the splints are reapplied they are adjusted to take up the increased extension and dorsiflexion which will be obtained if the case is progressing. Most cases recover in a surprisingly short period—two to three weeks. But the treatment is essential.

SPRAINS, STRAINS AND CONTUSIONS

Such injuries, which are due to blows, twists and wrenchings, may affect any tissue. The severity of the trauma often bears little relationship to the disability produced. For instance a simple blow on the front of the shin, which is very common, may give rise to a mere passing discomfort, or to an intense throbbing ache which persists for days. A simple fall on the shoulder or on to the hand may be passed off as of no importance, and yet give rise to pain and limitation of shoulder movement which requires treatment for six months. Long after the acute stage of a sprained ankle has subsided, complications due to muscle weakness, adhesions or swelling may continue for a very long period. Consequently we must institute an effective form of treatment from the very first. It is unfortunate that too many patients are not seen until the late or secondary conditions are established. We have, therefore, to consider every type of case from two aspects; (1) the acute stage, and (2) the chronic or secondary stage.

MUSCLE STRAINS

Muscle sprains are not very common except among athletes or as affecting the trunk muscles of workmen, notably miners and those who have to carry heavy weights. The majority respond rapidly to the soothing influence of heat and light massage. To be effective this must be given very early, very proficiently and very frequently. The limb muscles respond equally rapidly to the support of firm strapping, and it is seldom that one need arrange for physiotherapy.

The industrial trunk injury constitutes one of the major problems of relatively minor injuries. Perhaps it is because consultants and physiotherapists do not see cases until many weeks have been wasted by the prescribing of liniments. The untrained cannot massage so that to give a "rubbing bottle" is very little better than to give no treatment at all. Another difficulty is that so many of the patients who are middle-aged are suffering also from arthritis of the spine, and the picture is a complex of the two conditions. It would be out of place in this paper to discuss the full treatment of these cases. All that one can do is to indicate where the physiotherapist can assist the surgeon.

If it is decided to give heat, etc., in the acute stage the patient ought to attend twice daily and be given a prolonged bath of radiant heat or infra-red rays, followed by massage carried out no more heavily than the patient can tolerate. After several days of this the inflammatory changes will have subsided. Deeper massage, faradic stimulation of the painful area, and physical exercises are given to prevent the formation of intramuscular adhesions.

In the later stages, and sometimes during the course of the above, two additional forms of treatment may be instituted. The late cases will have developed adhesions. These can be " broken up " most effectively by manipulation of the back or the injection of a local anæsthetic. Although it is possible to manipulate many backs without anæsthesia, there is much to be said for the use of an anæsthetic. Beside complete relaxation and absence of pain during the manipulation, a strong psychical effect is produced. After the patient has recovered from the anæsthetic, physiotherapy must be continued or commenced in order to ensure that the adhesions do not reform. The interval between the manipulation and commencement of treatment can be completely eliminated if the anæsthetic used is a local infiltration of novocaine. By using this in selected cases where the painful area is relatively small, one abolishes pain at once, breaks up the adhesions by the mechanical effect of the injection, and ensures a period of several hours during which the absence of pain allows of immediate treatment and full activity. This activity being painless, encourages the patient and, because normal activity is the finest form of treatment, we are giving our patient the most efficient measures. But despite this, far too many cases fail to recover as we expect.

SPRAINS OF LIGAMENTS

Sprained ankles are very common. They have in the past, they do now, and they will in the future provide much employment for the masseuse. All who have had experience of them know that there is intense pain for two to four days, which is relieved a little by cold compresses or by infra-red therapy. After this there is a period of decreasing pain when the addition of massage is of benefit. Later still the adhesions respond to strong passive movements or to manipulation under an anæsthetic, while the swelling which recurs after exercise still needs massage.

A few years ago orthopædic surgeons started to apply firm elastoplast bandages to sprained joints. As a result of this not only was the physiotherapist's field reduced, but so was the patient's pain and period of disability. More recently, further advances have led to the treatment by injection of a local anæsthetic. The theory of this treatment is that, as no one had ever been able to see any damage to tissues in cases of sprain, the cause of pain must be a disordered reflex. This would account for the persistent pain and the swelling. If, therefore, we could break an abnormal reflex or restore a disorganized one, the symptoms ought to be relieved. It was found that injections of novocaine or similar local anæsthetics did this. There were only two draw-backs; one was that, after a few hours of relief, a period of intense aching lasting for several hours made the patient regret having submitted to the injection. We can overcome this objection by freezing the skin over the site of pain with an ethyl chloride spray instead of injecting the novocaine. It sounds like magic, but it is a fact that many patients will hobble in with an intensely painful and swollen foot and will walk briskly out of the room after the freezing. Not only this but in some cases the swelling subsides in a few hours. And all this without the wearing of any supporting bandage. The second objection is that not all patients are cured. This applies to any method of treating any condition. Where this is a failure one resorts to the old methods.

Another ligament which is commonly injured is the internal lateral (medial collateral) ligament of the knee. The knee cannot be extended fully because this

Continued on page 56

MAINS-SUPPLIED VALVE OSCILLATING CIRCUITS

By L. G. H. SARSFIELD, D.Sc., M.I.E.E., A.Inst.P.
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Continuing the Series of Papers on
ELECTRO-MEDICAL APPARATUS : ITS CHARACTER, OPERATION AND CARE. PART II. No. 7

IN the December issue of this *Journal*, some details were given of the manner in which high-frequency oscillations can be generated with the help of thermionic valves. Fig. 132 showed a simple oscillating circuit in which batteries were employed to heat the valve filament and to supply the energy in the plate circuit.

In modern apparatus, batteries are rarely used, but the necessary electrical energy is obtained from alternating-current mains through appropriate transformers. In view of the fact that, under these conditions, alternating current is used to heat the valve filament, readers will realize that the constantly changing value of the current corresponding to the alternations is liable to give a constantly varying temperature to the filament. In many cases in practice the filament behaves sufficiently as a reservoir of heat and the alternations occur so quickly (fifty per second) that the temperature changes are not generally important. When these temperature changes, however, are important as with wireless valves, an additional electrode is employed which is not in electrical contact with the filament, but is assembled very near to it so that it becomes hot. This electrode is often in the form of a metal sleeve mounted over the filament and it incorporates enough metal to maintain an even temperature.

The use of a transformer for energizing the main circuit of the valve means that alternating potential is applied to the plate instead of a constant positive potential as shown in the battery circuit of Fig. 132. Since the valve will only conduct current in one direction (i.e. from the plate to the filament when the former is positive), it functions as a rectifier.

A MAINS-SUPPLIED VALVE OSCILLATING CIRCUIT.

An example of a mains-supplied valve oscillating circuit is shown in Fig. 133. There is an almost unlimited variety of ways in which connections may be made to produce oscillations, and the example in the figure is only given to indicate how transformers may be used to replace the batteries and how high-frequency circuits are isolated from power-frequency ones.

The filament-heating transformer T_1 is shown connected direct to the mains with a variable resistance in the primary for regulating the temperature of the filament and hence the plate current in the valve. The regulating resistance is sometimes connected in the secondary of this transformer instead of in the primary; this is possible since the secondary winding is earthed to point E. A high-frequency* choke M_1 is connected in the secondary (filament) circuit of this transformer to prevent high-frequency oscillations reaching the mains.

The main transformer T_2 for energizing the high-frequency circuit is connected to the supply by one of a series of tappings which enable different primary voltages to

* The choking action is due to the induction of an E.M.F. in the coil in opposition to the high frequency current. It will be remembered that the direction of an induced E.M.F. is such as to oppose the current which produces the E.M.F. Since the value of the induced E.M.F. is proportional to the rate of change of the current the choking effect will be great at high frequencies and small at low frequencies. Therefore the choke effectively stops high frequency currents from the oscillating current but lets through low frequency currents of the filament heating circuit.

be utilized. The transformation ratio of T_3 will, of course, depend upon which tapping is employed. An auto-transformer may be introduced between the mains and the primary of the main transformer so that, with a fixed mains voltage, a variety of voltages may be applied to the transformer. This enables the voltage of the secondary of the main transformer, which energizes the oscillating circuit, to be varied.

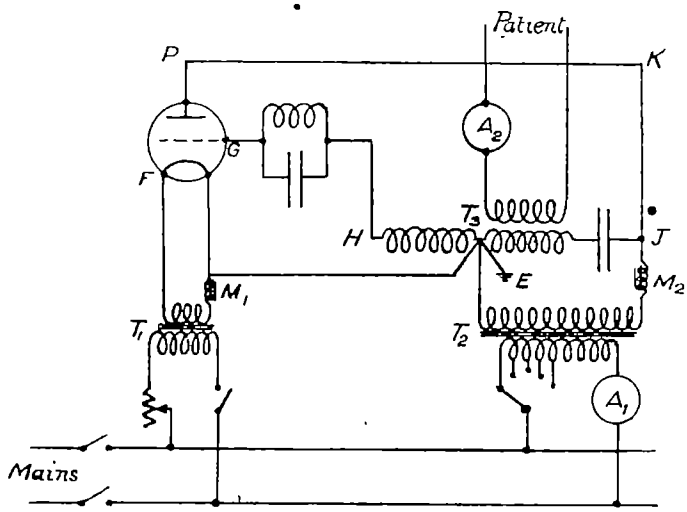


Fig. 133. A form of valve oscillating high-frequency circuit.

Both the filament and main transformers operate at low (mains) frequency, i.e., 50/60 cycles per second and are provided with iron cores.

The main transformer will produce a voltage of the order of 4,000 volts across the secondary and will apply a potential of 4,000 volts to the plate of the valve. Current will flow (in one direction only) between plate and grid and an oscillating current will be flowing in the circuit H.J. In order that the high-frequency current shall not get back on to the main transformer, a highly inductive choke coil M_2 is connected in the secondary circuit.

The coils in the part of the circuit H J behave as the primary windings of the high-frequency transformer T_3 which, of course, has an air core. The secondary of this transformer is connected to the patient. The patient current which is measured on the ammeter A_2 may be varied as follows:

(1) by altering the coupling (i.e. in effect, the distance) between the primary and secondary windings of the high-frequency transformer;

(2) by tuning the primary or secondary windings to resonance; or

(3) by varying the voltage from the main transformer.

Tuning (or the adjustment of the circuit to resonance) may be effected by variation of capacitance and inductance.

The patient terminals of a high-frequency apparatus are taken to electrodes which are designed for one of the following principal means of utilizing the high-frequency currents:

(*a*) plate electrodes for application to the body for the transmission of diathermic currents through parts requiring treatment;

(*b*) a plate (indifferent) electrode and a surgical (active) electrode for surgical and coagulating work with diathermic currents;

(*c*) a cable to be coiled round or upon a part of the body requiring short-wave treatment; and

(*d*) disc or plate electrodes which form the plates of a condenser between which the whole body or a particular member can be introduced to receive short-wave currents.

COUPLING

Two circuits are said to be *coupled* when the oscillations in one of them are transmitted to the other. As observed previously* the closely disposed windings of a transformer have a high degree of coupling. An auto-transformer has a maximum amount of coupling since the primary and secondary windings are, as it were, fused together to form a single winding having taps for input and output of electrical energy. Moreover, at power-frequencies the transfer of energy from one winding to the other is very efficient due to its use of a magnetic core.

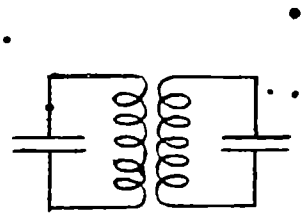


Fig. 134. Diagram illustrating the inductive coupling of two coils.

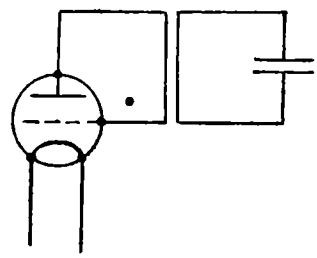


Fig. 135. Diagram illustrating mixed inductive and capacitative coupling.

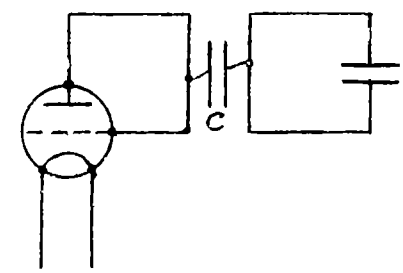


Fig. 136. Capacitative coupling increased by condenser.

In transformer coupling the greater proportion of the energy received in the secondary winding is by magnetic induction, but there is also another form of coupling operative at the same time. This is called capacitative coupling since the respective windings behave like the plates of a condenser and the insulation between them as a dielectric.

With capacitative coupling the energy is transferred from one circuit to the other by the electric field and, of course, very much smaller quantities can be transmitted by this means. In the case of medical work, iron cores are not employed in the high-frequency transformers and the amounts of energy involved are smaller than with power transformers.

A familiar example of inductive coupling is seen in Fig. 134, and one of capacitative and inductive coupling mixed in Fig. 135. The straight wires in the latter circuit have a little inductance and therefore the circuit cannot be called truly non-inductive.

The capacitance represented by the two adjacent wires is small, since the areas of the wire "plates" are small. If it is desirable to increase capacitative coupling between two such circuits a condenser may be connected as shown in Fig. 136.

Now, the energy in the secondary circuit of a closely coupled pair may be such as to swing to a frequency governed by its own values of capacitance and inductance so that it induces back into the primary its own frequency with the tendency to alter the primary frequency. Coupling giving rise to this condition of affairs is generally known as *critical coupling*.

In a manner similar to that explained when the subject of the production of oscillating currents was dealt with, high-frequency currents in a patient circuit may be weakened by ohmic resistance and hence thick wires are used. Radiation losses also occur by the escape of electric waves which do not thread any of the useful circuits involved in the apparatus.

These notes on coupling will, it is hoped, present the elements of the subject to

* *B J.P.M*, 1938, vol. 1, New Series, p. 390, Nov.

readers unfamiliar with them and also assist readers to interpret the significance of circuit arrangements as indicated in wiring diagrams.

The natural oscillation frequency of a circuit (and consequently its characteristic wave-length) can be measured by bringing a wavemeter alongside it. The wavemeter consists essentially of a variable condenser and an inductance connected through some indicating instrument such as an ammeter or a telephone. The wavemeter is brought near enough to the circuit required to be measured so that oscillations are induced in the meter. Now the variable condenser is adjusted until a maximum reading on the ammeter or loudest sound in the telephone indicates maximum energy swinging in the wavemeter circuit. The value of the capacitance for the chosen condenser setting and the value of the inductance of the wavemeter are known and these correspond with a particular wave-length in accordance with the relationship already stated.*

A VALVE OSCILLATING CIRCUIT FOR SHORT WAVES

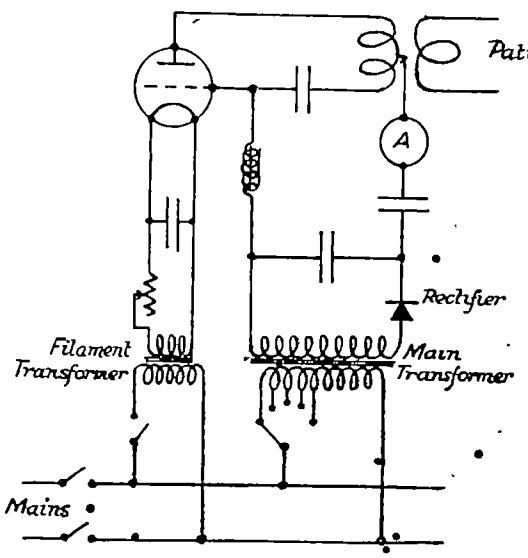


Fig. 137. A form of oscillating circuit for short waves.

The essential difference between high-frequency apparatus for short, medium and long waves lies in the design of the coils and condensers which make up the oscillating circuit. Readers will remember that wave-length is proportional to the product of inductance (L) and capacitance (C)**; therefore, if short waves are required (with correspondingly high frequency), the product L C must be small. In practice, the values of both L and C are made small. The inductance coil may have as few as two or three turns while the condenser has a capacitance of the order of 0.02 microfarad†. The valve itself possesses capacitance and this quantity contributes to that of the valve oscillating circuit. For short-wave and ultra-short wave work the valve must be designed to have as low a capacitance as possible.

Fig. 137 shows a circuit arrangement for a short-wave set. Tuning of the oscillating circuit is often an operation requiring a delicate adjustment of distance between the coils or of their relative positions. Special mechanisms for coil movement are sometimes incorporated in apparatus to provide for this and graduated control knobs conveniently convert simple turning movement into accurate tuning adjustment.

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* *B.J.P.M.*, 1938, vol. i, New Series, p. 319, Sept.

** *B.J.P.M.*, 1938, vol. i, New Series, p. 319. Sept.

† One microfarad equals the millionth of a farad. The farad is the practical unit of capacitance. The capacitance of a condenser is defined as the quantity of electricity necessary to produce a potential difference of one unit across its plates. Thus, a farad is the capacitance of a condenser into which a coulomb of electricity must flow to produce a potential difference of a volt across the plates. A coulomb is the quantity of electricity corresponding to a current of one ampere flowing for one second.

As stated in *B.J.P.M.*, Nov., 1938, vol. i, New Series, p. 390, the capacitance of a condenser depends upon the area of the plates, their separation and the material forming the dielectric.

Although there are many high-frequency machines where no rectification is employed for the anode energizing circuit, this is not always the case. In Fig. 137, a rectifier valve is introduced in the secondary winding of the main transformer. From a review of the literature of this subject it is evident that experimenters and manufacturers have their own preferences regarding circuit connections, methods of coupling of the patient circuit, the use or rejection of rectifiers in valve energizing circuits, etc., and a detailed treatment of these matters would become a source of confusion instead of assistance in our attempt to put forward the main principles of the apparatus. References will be made to distinctive features of circuit design when particular examples of diathermic and short-wave machines are considered in this series.

MEASURING INSTRUMENTS FOR USE IN HIGH-FREQUENCY WORK

Voltage.—The measurement of voltage at high frequencies is a very difficult matter and in general may only be done by an indirect method such as primary to secondary turn ratio (knowing the voltage on the former) or by comparative capacitance currents to earth from a point in the winding being investigated and a standard winding of known voltage and frequency. At present, voltage values do not seem to be very important although experiments are being conducted by some physicists to ascertain the significance of voltage in application of short waves to the human body.

Current.—Ammeters are used for measuring the current delivered to the patient circuit. Specialists in the use of diathermic and short-wave currents regard the ammeter as a useful guide to the electrical energy passed to the patient but emphasize the vital importance of observing the patient's physical reactions and other clinical data.

The ordinary moving coil and moving iron instruments are unsuitable for measuring high-frequency currents and, therefore, hot-wire and thermo-couple type instruments are used.

Details of the hot-wire type instrument were given in Part I of this series.* In this instrument it will be remembered that the heating of a wire carrying the current to be measured causes movement which is conveyed to an indicating needle. This type of instrument is not perfect for this work for, although the wire heating is independent of frequency, the incidental capacitances inherent in the construction of the instrument behave as shunts to the heating wire so that some of the current by-passes it, thus producing a false (low) reading. This effect is greater the higher the frequency, and the shorter the wave-lengths employed.

Another form of high-frequency current ammeter employs the thermo-couple as the means of measurement. The principle of the thermo-couple was given in an earlier paper.† In this instrument a small element heated by the high-frequency current is in contact with, or very near to, a junction of two metals and the rise in temperature of the junction sets up an E.M.F., which produces a small direct current. This current, passing through a fine wire coil incorporated in the instrument, causes movement of an indicating needle in the familiar manner of a moving coil ammeter. Movements are also present in this type of instrument due to capacitative effects.

Temperature.—The temperature rise of various parts of the body, particularly in cavities where access of an instrument is possible, can be measured by the pyrometer. This instrument incorporates thermo-junctions at the point applied to the body, and these junctions are electrically connected to an indicating voltmeter or ammeter, calibrated directly to read degrees centigrade.

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* *B.J.P.M.*, 1937, vol. 12, p. 55, July.

† *B.J.P.M.*, 1938, vol. 1, New Series, p. 277, August.

PSYCHOLOGICAL FACTORS IN PHYSIOTHERAPY—*continued from p. 46*

The commonplace, the obvious, the rational, the arduous are all elements in ætiology and treatment that these people eschew.

Psychological Difficulties

In conclusion, I would venture to remind you that the physical therapy specialists have a psychological difficulty within themselves. In a sense every specialist has this difficulty, that is, that he has an unconscious bias towards his own department and his own methods. The best analogy comes from climatology. On this subject I speak with some assurance, because I practised for some time in a foreign health resort. I slowly began to perceive that I rarely or never saw a patient who, in my opinion, would do better in any other climate. I then had to face the fact that my vested interest in the climate of that particular resort was inducing such a strong bias as to render my discrimination deplorably ineffective. It is the same with you. Not only have you a vested interest in your speciality like every other specialist, but most of you have a very serious vested interest in your equipment. Far be it from me to suggest that you have in consequence become panacea-mongers, and that you knowingly attempt to cure every patient that comes to you by physiotherapy. Nevertheless, I submit with all deference that, in the nature of things, the physical therapy specialist is more liable than most specialists to that unconscious bias which tends to warp diagnostic discrimination.

PHYSIOTHERAPY AND ORTHOPÆDICS—*continued from p. 50*

position puts the ligament on the stretch and causes pain which is felt at its upper attachment. As in the case of the ankle joint, we have the same choice of forms of treatment, of which the simplest is not physiotherapy, but the injection of a local anæsthetic followed by firm strapping, wedging of the inner side of the sole and heel and full activity.

(To be continued)

THE BRITISH JOURNAL OF PHYSICAL MEDICINE

Title Page and Index to Volume I, New Series.

The title page and index to Volume I of the New Series of the *British Journal of Physical Medicine* is published with this issue and included in all subscribers' copies. The publication of this index is a confirmation of the increasing scope of physiotherapy and the growing British interest in the subject.

For subscribers who wish to have their copies bound, the Publisher has available cases in red cloth lettered in black. Cases are made in two sizes: (a) to take title page and index, reading matter *plus* advertisements; and (b) to take title page and index and reading matter only. Full particulars of prices, etc., for binding cases and binding Volume I of the New Series is published on advertisement page vi. To complete volumes for binding, back numbers of the *Journal* can be supplied to subscribers at the subscription rate.

Electrolysis

A. C. Cipollaro (*Jour. Am. Med. Assocn.*, 1938, cxi, 2488) considers electrolysis is the only remedy for curing hypertrichosis safely and adequately. Hairs should not be removed from an inflamed area; the smallest amount of current that will permanently remove hair should be employed; contiguous hairs should not be removed at one sitting. The needle must pass through the orifice of the follicle and should not be left in the follicle longer than necessary. The parts to be treated should be cleansed with soap and water, then with a fat-solvent, and finally swabbed with alcohol. After treatment is concluded the skin should be swabbed with alcohol and dried and a calamine lotion containing 1 per cent. phenol should be applied for from 24-48 hours. Moles and nævi are also best treated by electrolysis.

THE WORLD'S NEWS AND VIEWS ON PHYSICAL MEDICINE

INTERNATIONAL REVIEW

THE PHYSIOLOGICAL ASPECTS OF RHEUMATISM

Report of Meeting of the Physical Medicine Section of the Royal Society of Medicine, January 20th, 1939

At a meeting of the Section of Physical Medicine of the Royal Society of Medicine on January 20th, Professor SAMSON WRIGHT gave an address on the physiological aspects of rheumatism. He began by discussing the problem of the mechanism of the sense organs which he said had been investigated in recent years by Adrian and other physiologists, using especially electrophysiology; a number of general principles had emerged which were comparatively clear and straightforward. The intensity of any sensation seemed to be associated with the frequency of impulses in the sensory nerves. If this was of low frequency the intensity was low, if high —say 50 or 100 per second—the intensity was correspondingly high. The extent of the sensation depended on the number of nerve endings and nerve fibres put into action at any moment, and, therefore, of the area of cerebral cortex which was activated.

The most difficult problem of all was to account for the quality of sensation. The frequency of the impulses, the number of fibres, the anatomical connexions did not help in understanding this; it depended on some mysterious characteristic in some region of the brain, but as to which area of the brain was involved in the conscious sensation of pain, there were still disputes. Pain was, therefore, a sensation in itself, not merely an intensification of other sensations. Sir Thomas Lewis had suggested that a complete description of pain should comprise a statement of its severity, its kind or quality, and its relation to time, locality, and circumstances. The duration and intensity might be of great diagnostic value, and so might the localization, though the localization of pain was difficult, particularly if a considerable time had elapsed between the appreciation of the pain and the examination, or when the pain involved deeper visceral or somatic structures.

Three kinds of somatic pain existed, arising respectively from the skin, the muscles and the tendons. Skin pain, however produced, was always essentially of the same quality. If the pain stimulus was brief, the patient felt a pricking pain; if more prolonged, a burning pain. The muscles had pain sensations of their own, disagreeable, continuous, fluctuating in intensity, often diffuse and difficult to locate, but the patient could usually distinguish them quite clearly from skin pain. A point of importance with reference to muscle pain was that it might be referred to distant parts. A third pain was that which was felt in the tendons, fascia, and periosteum. This was sometimes called web-pain because it was analogous to that produced by pinching the web between the fingers. Perhaps the most interesting form of deep pain was that produced in muscles by ischæmia. This could be produced by obstructing the circulation to a limit and exercising the limb. After a short period pain set in and became increasingly severe and ultimately quite intolerable. It was not due to spasm of the blood vessels beyond the point of occlusion, because actually the vessels beyond that point underwent dilatation. It was not due to muscular tension, and analysis suggested that it was probably due to some chemical products; perhaps some metabolite was formed which, so long as the circulation was intact, could be combusted or removed, but under conditions of ischæmia the metabolites would accumulate and, on reaching an adequate concentration, pain was produced.

Professor Wright then went on to discuss what he described as the rather obscure chemistry of muscle injury or activity leading

to the liberation of substances which might produce not only local, but reflex, effects and chemical effects at a distance. From this he turned to some considerations of massage. Superficial stroking was said to improve the cutaneous circulation, especially by promoting flow in superficial veins and lymphatics. These claims ought to be examined critically in the light of current physiological knowledge. A very light stimulation acted directly on the capillaries of the skin, resulting in a contraction of the capillary wall. If the stroking was more vigorous it would produce a varying degree of vaso-dilatation, depending on the strength of stimulation employed and the susceptibility of the subject. The reactions resulting from stronger stroking seemed to be due to the liberation of a histamine-like substance in the skin, or some unstable precursor. The capillary dilatation was due to a direct action of this substance on the capillaries. It was probably inaccurate to stress excessively the effects of this kind of stroking on the flow in the lymphatics, because, judging from experiments in normal animals, the resting rate of flow in the lymphatics was very small as compared with that in the veins. It was improbable that this mechanical effect on the lymphatics could contribute very much to facilitating fluid exchanges. With regard to reflex effects, adequate and properly-controlled clinical investigations were somewhat scanty. Deep stroking would produce greater mechanical effects and possibly influence the underlying viscera. But minute tissue damage from deep stroking might liberate metabolites in sufficient number to enter the blood stream and produce effects at a distance. The sweeping claims made for compression and percussion movements also needed to be examined critically. The degree of muscular activity introduced by massage, local or general, was too small to be measured. There were no significant changes in the blood. Some local effects were produced in the muscle. Blood pressure might be raised by increasing the venous return or lowered by local vaso-dilatation in the muscle itself.

With regard to artificial hyperpyrexia, a procedure widely followed, the pulse rate might go up to 160 per minute, the systolic blood pressure show variable changes, rising, but possibly falling seriously, and the diastolic pressure might fall even to zero which must adversely affect the heart action. With this procedure the respiration might be seriously altered, long bouts of apnœa occur, and generally a kind of Cheyne-Stoke's breathing. Probably the most important changes in artificial hyperpyrexia were those in the blood due to water loss. Unless that water loss was compensated for, not by the administration of water, but of saline, trouble was likely to arise. He thought the blood changes in electro-pyrexia had not been studied adequately, but various changes occurred in the body under conditions of extreme heat and it would certainly be worth while to make an extended study of them all.

In the course of a short discussion, Dr. KERR RUSSELL referred to a method of artificial hyperpyrexia used at the National Temperance Hospital which was much more comfortable to the patient than previous methods It was a method whereby nebulized hot water was employed, so that there was less sweating, and consequent less loss of salt. With the earlier methods the patient suffered a good deal from muscle cramps, which did not now occur.

Dr. C. W. BUCKLEY referred to a condition which patients called " the fidgets." This was a sensation, chiefly in the calf muscles, generally arising when one was trying to drop off to sleep and might become almost intolerable. It suggested a minor degree of that form of muscle pain which occurred if a muscle was exercised after the circulation had been obstructed. It seemed to be due to some products of muscle metabolism, and yet, bearing in mind that the trouble occurred when the muscle was at rest, what were they?

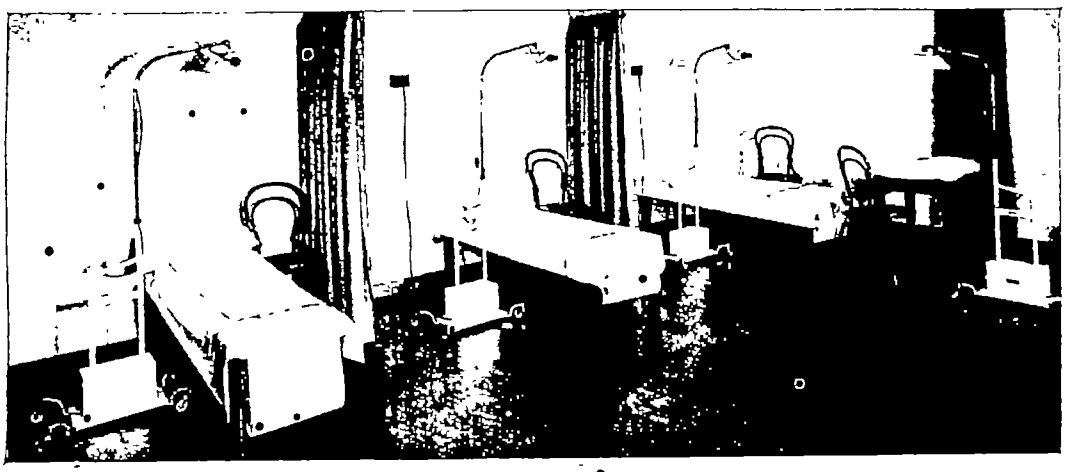
Sir WILLIAM WILLCOX said that Professor Wright had given an excellent physiological description of the various forms of massage but, after all, they all knew that the proper application of massage did a great deal of good, and the proof of the pudding was in the eating.

Professor GEOFFREY HOLMES referred to the lack of text-books on physiology likely to be of service to practitioners of physical medicine

Professor WRIGHT, in reply, said that he had not intended to cast aspersion on the results of treatment, but it seemed to him always a mistake to offer some facile explanation of such results, or to put forward some pseudo-scientific hypothesis. It was much better to say frankly that the treatment was empirical. He felt strongly the unhappy position of the massage student, who was being taught a mass of pseudo-scientific facts to which very few people would be prepared to swear. It would be better to teach them as craftsmen simply to carry out certain manipulations, knowing that such manipulations, without any particular reason, led to certain results.

ROYAL SOUTH HANTS AND SOUTHAMPTON HOSPITAL: OFFICIAL OPENING OF NEW MASSAGE AND ELECTRICAL DEPARTMENT, 4TH FEBRUARY, 1939

Evidence of progress by British Voluntary Hospitals in spite of financial difficulties comes from Southampton, where, after speeches by the Mayor, an address from the Chairman of the Committee of Management and a report by Dr. D V. Rice, Mrs. Lionel de Rothschild, in a few well-chosen words, declared the new department open. Sister Reeves then handed a cheque for £500 to Mr. C. F. Hiscock, the Chairman of the Executive Committee of the Centenary appeal, a striking tribute to the loyalty of the staff to the Hospital.



The New Ultra-Violet Irradiation Treatment Room at the Royal South Hants and Southampton Hospital.

The new Massage and Electrical Department is by no means a new departure of the Southampton Hospital, but rather the finding of a new home for up-to-date equipment and an extension of treatment facilities. The first department was inaugurated in 1908, and during the first year 198 patients were treated. The efficacy of electrical treatment and the confidence now placed in this treatment medium are evident from the fact that more than 30,000 treatments were given during 1938. In 1908 there was one sister, who, as part of her duties, had to look after the X-ray plant. Now there is a fully qualified staff of seven in this department alone.

Sister Chidgey, who has been with the Hospital for nine years, was responsible for the organization of the new department, and demonstrated to those present the airy lay-out of the rooms and the new equipment. The ultra-violet equipment consists of the well-known Philips Biosol lamps. Ultra-violet rays are used for a wide variety of purposes, sometimes as a general tonic when the spectrum of the lamp should resemble as closely as possible the spectrum of midsummer sunshine, and at other times for intensive treatment to induce rapid erythema. With the Biosol both conditions can be treated with the same lamp. The "Dorno" filter can be placed over the burner and will cut off the shorter wave-lengths; simply by removing the filter the full spectrum of the lamp is used. Other advantages claimed for the Biosol lamp are that the burner, containing such a minute quantity of mercury, is free from danger of causing cracking of the lamp, and the special type of reflector increases the size of the field which can be irradiated at one time.

The 12 combined-treatment tables which have been installed at the Hospital are also supplied by Philips. Each table gives 20 different combinations of galvanic, faradic and sinusoidal current and permits of the treatment of a wide range of diseases. Being easily manipulated, they simplify and accelerate the work of the staff.

The Royal South Hants and Southampton Hospital is to be congratulated on their enterprise in providing such a fine physiotherapeutic department.

OPENING OF WOOLWICH CENTRAL HEALTH CENTRE

On Saturday, the 14th January, Lord Horder opened the magnificent new Health Centre of the Metropolitan Borough of Woolwich. This establishment, which cost £18,000 to build, is equipped for the working of electrotherapy, massage, dental and chiropody clinics, orthopædic treatment, maternity and child welfare work and school medical services. A noteworthy feature is the provision of air-raid shelters.

The special treatment rooms, five in number, comprise an orthopædic room, two for electrotherapy and massage, one dressing room and one bathroom. In the walls of the electrotherapy rooms a Faraday cage has been constructed to prevent interference with neighbouring wireless sets by short-wave therapy apparatus.

ST. JOHN CLINIC AND INSTITUTE OF PHYSICAL MEDICINE. ANNUAL REPORT FOR 1938

An examination of the Annual Report for 1938 of this well-known London Clinic clearly shows the important work being carried out in physical medicine, and the excellent results being obtained therefrom In the Light Department, for example, 44,283 treatments were given during the year for a variety of local and general conditions. In the Balneological Department, 6,729 treatments, including foam baths, foam baths with CO_2, aerated and brine baths, peat baths and vapour baths, were given. The Electrotherapeutical Department, which is equipped with sinusoidal apparatus, galvanic batteries, pantostats, faradic batteries, diathermy and ultra-short-wave machines, administered 56,938 treatments. In the Special Departments, such as the Ear, Nose and Throat, the Inhalation, the Gynæcological and the Intra-pelvic Diathermy Departments, great activity also took place. In all, 139,319 treatments were given by the various departments during the year, and the number of new patients received was 3,171.

ASTHMA RESEARCH COUNCIL—REPORT OF PROGRESS DURING 1938

In the report of progress during 1938, the Asthma Research Council describes the results obtained from the study of small but carefully selected groups of patients. It was found that general treatment alone gave at least as good results as general treatment combined with desensitization to inhalant proteins, and better than desensitization alone. The preliminary work carried out on the use of vaccines does not indicate that there is likely to be any great confirmation of their therapeutic value in asthma. On the other hand, very clear evidence has been adduced as to the importance of the psychological factor; this was particularly shown by the effects of employing normal saline only in rhinorrhœa. Of 32 patients, 13 were cured or much improved, 6 showed some improvement, and 13 none; these were better results than those obtained in 1936 with a solution of mixed inhalant proteins. In 1939 an investigation will be made on the effects of pollen desensitization in hay-fever. The staff of the clinic also propose to study in greater detail the non-allergic factors which may determine the individual attack of asthma. The St. Thomas's Clinic have found short-wave therapy, especially if associated with breathing exercises, to be of curative value in chronic rhinorrhœa. Many other interesting features of asthma research are described in this Report, copies of which may be obtained free from the Asthma Research Council, c/o King's College, Strand, London, W.C.2.

ROYAL INSTITUTE OF PUBLIC HEALTH AND HYGIENE

The Minister of Health, the Rt. Hon. Walter Elliot, M.P., has accepted the invitation to act as President of the Public Health Congress to be held by the Royal Institute of Public Health and Hygiene at Hastings, from 23rd to 27th May

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

Intra-Oesophageal Diathermy in Dysphagia and Cardiospasm

M. Brunner (*Arch. Phys, Ther.*, 1938, xix, 671), has devised a diathermic intra-œsophageal probe-electrode for use in cases of dysphagia and cardiospasm. This apparatus consists of a fairly strong œsophageal rubber tube, which has attached to its lower part a balloon of electric conducting material. Through the tube there runs a conducting wire, the end of which surrounds the tube in the shape of a broad ring in the interior of the balloon. An opening in the distal end of the tube enables the balloon to be filled and the liquid to be removed. The technique of its use is as follows: The balloon is placed in contact with the lesion, the end of the wire is connected with one terminal of the diathermy apparatus and the other lead is attached to two medium-sized lead plates fixed to the back and chest of the patient. The diathermy current is switched on, the tube filled with a solution of salt water, after which the current is increased. The author finds in the 264 cases treated, 207 (78 per cent.) completely recovered; 27 (10 per cent) completely recovered but had relapses caused by psychologic trauma or other diseases; 19 (8 per cent.) showed distinct improvement: and 3 (1 per cent) gave no result. Physical therapy gives the best prospects of healing. In spastic symptoms, internal diathermy should be used with simultaneous dilatation; with atonic symptoms, internal and external faradization should be employed, and in neurasthenic and hysterical symptoms, internal treatment should be combined with the d'Arsonval high-frequency current.

N.B.—The figures given only account for 256 cases and the percentages amount to 97 per cent. —*Abstracts Editor.*

Hyperpyrexia in the Treatment of Ocular Syphilis

A. N. Lemoine (*Arch. Phys. Ther.*, 1938, xix, 675), reaches the following conclusions after the treatment of interstitial keratitis, syphilitic neuro-retinitis, primary optic atrophy and chorio-retinitis by means of hyperpyrexia produced by the hot bath. Fever therapy relieves the symptoms, clears up the salmon patches and the corneal opacities more rapidly than any other treatment; by following it up with chemotherapy the disease seems to be arrested permanently. The perivascular infiltration and swelling of neuro-retinitis clears up more rapidly with fever therapy than by any other treatment, and when it is followed by chemotherapy there have been apparently no recurrences. Fever therapy arrests primary optic atrophy in many cases and improves the acuity and field of vision in some instances. Fever therapy, produced by the hot bath, is as efficient as that produced by cabinets or malarial parasites, but the results are not quite so rapidly produced as by the latter.

A New Type of Mercury Glow-Lamp

R. Kovacs (*Arch. Phys. Ther.*, 1938, xix, 661), describes his experiences with a new type of ultra-violet generator. This is a filament-controlled mercury-vapour lamp, operating at very low pressure, with a very thin window capable of passing radiations as short as 1,850A. The filament, which is separately energized, is of the high emission type, flanked by two anode plates connected respectively to the middle and ends of a small transformer, maintaining a sixty-cycle arc. The envelope or bulb is of high transmission glass and the thin window, an indrawn bubble about 1/1,000 of an inch thick, serves to maintain the vacuum while offering very little filtering effect to the short wave-length radiation. Emission of energies between a wave-length of 5,790A and 1,850A are recorded by the spectrograph. The entire radiation shows ultra-violet rays, 55 per cent., visible rays 10 per cent., and infra-red rays 35 per cent. Exposures were made with the lamp over normal skin areas for five minutes and a diffuse erythema followed at once. In due course the erythema disappeared without leaving any pigmentation or causing any blistering. If the exposures lasted for ten minutes the erythema appeared in the same time as in the case of the shorter exposure. There was a slight peeling but no blistering, and, later, slight pigmentation. An exposure of 20 minutes produced the same erythema,

which lasted for two weeks, and pigmentation was visible for six weeks. The author reports his clinical results with this lamp on pyogenic affections, such as impetigo, sycosis, furuncle; on fungus and parasitic diseases; on ulcers and wounds; and on a number of miscellaneous affections, such as adenitis and eczema. His results compare favourably with those obtained by other apparatus; pain was quickly relieved in some cases of ulcer and minor skin affections, and the lesions cleared up rapidly.

Sciatica and Its Treatment

W. Harris (*Brit. Med. Jour.*, 1938, ii, 1,245), describes the types of sciatica, then discusses the ætiology, diagnosis and treatment. The latter varies according as the type is low or high. The low type is due to lesions in the neighbourhood of the sciatic notch, and the high to lesions in the neighbourhood of the intervebral foramina, around the fourth and fifth lumbar nerves. In the low type, rest in bed is essential and radiant-heat or infra-red irradiation often gives great relief. Short-wave therapy has been found to be of value when other treatments have failed, but the author has not as a rule found diathermy to be of much use. Galvanism often aggravates the pain in the acute stage, but may be of value in the chronic stage. Moist hot-packs or mud baths as employed at various spas, such as Harrogate or on the Continent, may be given in chronic cases. Rest in bed is essential for the acute cases. If the pain is very severe, analgesics are necessary, with local applications of liniments. The use of massive injections of novocain and saline may be used with great benefit. Other forms of treatment are discussed, but do not come under the subject of physiotherapy.

Elliott Treatment of Pelvic Inflammatory Diseases

E. C. Smith (*New Orleans Med. and Surg. Jour.*, 1939, xci, 351) reports on 73 ambulatory patients treated by the Elliott method. The cases are divided into eight groups (1) Acute and sub-acute salpingitis, specific, 12 cases. The acute stage must be treated at home until this stage is over. The results were good in ten cases and fair in two; average number of treatments twelve. (2) Subacute salpingitis, non-specific, 14 cases: the results were about the same as in the first group. (3) Chronic salpingitis, 17 cases: in seven cases the results were good, and in ten fair; a major surgical operation was necessary in eight cases. (4) Post-abortion parametritis, 8 cases: seven became symptomless and the other patient stopped treatment too soon (5) Post-parietal parametritis, 8 cases: six responded well, and in two cases the results were fair. (6) Endocervicitis, 7 cases: results were fair in four; there was no improvement in three. (7) Vaginitis, senile, 3 cases: results were fair in two; no improvement in one. (8) Post-operative inflammation, 4 cases: good in three; fair in one.

The temperature of the water should not be over 115° F. at the beginning, and should be gradually elevated at the rate of ½-1° per minute until tolerance of the patient is obtained or not more than 125° F. or 130° F. The duration of the first treatment should usually be 15 minutes, the second 15-25 minutes, third 25-30 minutes, fourth 35-45 minutes, and no treatment should be longer than an hour.

Treatment of Arthritis by Artificial Fever Therapy

H. B. Gwynn (*Rheumatism*, 1939, i, 17) chiefly uses artificial fever therapy in the treatment of gonorrhœal and non-specific infectious (rheumatoid) arthritis. He uses the Kettering hypertherm. Patients over 60 years of age, those with cardio-vascular disease or renal affections are not suitable. The patient is put into the chamber, heated to 130° F. with a relative humidity of nearly 100 per cent. In 1½ hours the patient's temperature rises to 106.6° F. to 107° F., which is the maximum for treating gonorrhœal infections: morphine is generally required as a sedative. During the treatment, about 2-5 litres of iced saline solution should be drunk. The length of time employed depends on the patient's condition. 76 cases of gonorrhœal arthritis were treated: the average number of treatments were four, with six to eight hours of fever varying from 106.6° F.-107° F. The average interval of treatment was three days, the average number of hours of effective fever was 24; 61 cases improved, 80 per cent. or more within two weeks of the conclusion of the fever therapy. Ten cases of non-specific infectious (rheumatoid) arthritis were treated, the average number of treatments being five, each consisting of five hours of fever between 104° F. and 106° F., making a total of 25 hours; five patients improved 80 per cent. or more, and three 50 per cent. or less.

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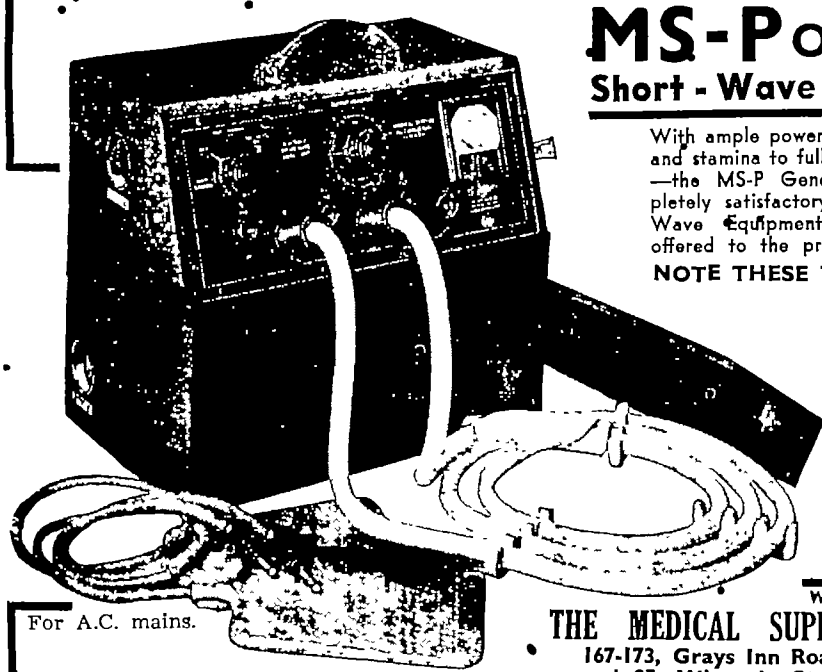
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REVIEWS of BOOKS on Physical Medicine and Allied Subjects

Essentials of Medical Electricity

Essentials of Medical Electricity. By E P. Cumberbatch, B.M. (Oxon), D.M.R E. (Camb.). (Eighth Edition), 528 pp., 147 illus. and 15 plates. Price 12s. London, 1939: Henry Kimpton.

In the course of its seven previous editions, this book has been so much enlarged and its matter continuously brought up to date that its modest title hardly does justice to its completeness and merits in its present form For, from being a mere exposition of the elements of its subject, it has developed into a most exhaustive text-book. Its recurrent publication in so many editions affords the best possible evidence of the need for such a book, and the name of its author is the best guarantee of the authoritative nature of its contents.

The early chapters call only for appreciative commendation and offer little or no ground for disagreement. They exhibit much painstaking and exhaustive consideration, and can be read with advantage by the student of electrotherapy.

In the chapters dealing with galvanism, and that dealing with ionization, Dr. Cumberbatch follows the orthodox path, and it is very gratifying to notice that the many preposterous claims which recurrently appear in relation to the action of the galvanic current, despite the repeated exposure of the fallacies that they involve, find no place in the pages of this book.

There are, however, many advanced workers who may differ in detail from the views expressed by Dr. Cumberbatch, and who may fail for instance to see the necessity for a distinction between Galvanism and "Ionization" (one of the most faulty of even medical terms). Galvanism needs for its administration through the dry skin of the patient some solution containing ions to transport the current. And, whether the ions contained in this solution are possessed of distinctive therapeutic properties or whether they are comparatively inactive, the application is that of galvanism, and it is certainly not "ionization," which is an entirely different phenomenon. The term "ionization," when employed in this connection, is faulty; since when correctly applied, it connotes an effect entirely opposite to the sense in which it is here used. The wrong use of this term has led to much confusion and misapprehension in the past, and its almost universal adoption is insufficient justification for its continued misapplication.

In chapter xi of this edition the author introduces for the first time the subject of "Galvanic Acupuncture." This method was first described by a French writer, Sarlandiere, in 1825, and a year later, in this country, Majendie wrote a book describing it. The technique has somewhat altered. Majendie employed two needles of steel or platinum He was an exceedingly bold operator, for he plunged his needles through the eyeball into the optic nerve.

As might have been anticipated, Dr. Cumberbatch devotes especial attention to the high-frequency current, a subject which he has done so much to advance by his researches and publications, and upon which he consequently writes with so much authority. The 134 pages which he devotes to these currents form a complete and reliable resumé of their nature and action.

In the chapter on the current derived from the static electrical machines, we are very far from being in agreement either with the views expressed on the nature or the therapeutic effects of these treatments; this is specially the case when the author deals with the static charge or bath. We are, indeed, forced to the conclusion that Dr. Cumberbatch's views have been influenced by working with an inefficient machine, incapable of an adequate output. It is obvious that a treatment which necessarily depends upon a very high voltage cannot be efficiently administered by means of a machine which is incapable of rendering the necessary high electrical tension. The static machine is one of the most valuable instruments employed in electrotherapy and is capable of yielding results unobtainable by any other means.

An index of treatments occupies 50 pages; this is no mere empirical enumeration of the treatments suitable for a large number of diseased conditions, for it explains in detail the methods advocated and their mode of action. A most useful chapter on Physical Principles concludes the book.

This book is fully illustrated, is so carefully produced, and is so comprehensive, that it cannot fail to appear in many more editions, and thereby aid the student and advance the development of electrotherapy. W. J. T.

AND INTERNATIONAL REVIEW.

J. M.
RECEIVED 11/4/35

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THE BRITISH JOURNAL OF PHYSICAL MEDICINE

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Manipulative Surgery

ON page 66 of this issue of the *Journal* Sir Morton Smart gives a very interesting and informative account of manipulative surgery and clearly shows how this much maligned subject can be employed with great benefit in the treatment of joint diseases.

Although manipulative surgery rightly comes within the province of physical medicine, to many general practitioners the subject is still looked on with suspicion.

The tardy recognition in "respectable" medical circles of manipulative surgery as a useful adjunct to orthopædic practice, was due to the fact that orthodox medicine for long would not stoop to investigate a subject which was practised with widely varying degrees of efficiency by the "bonesetter" and was, therefore, presumably unworthy of notice.

It is true that a bewildering multitude of worthless forms of treatment is constantly being advanced, not only by laymen, but sometimes by members of the medical profession itself. To examine all the often preposterous claims would require a vast amount of time and labour, which might be better directed to original controlled research.

Yet a careful sifting of all new forms of therapy which show some reasoned or insistent claim to investigation would appear to be wise. Only by such careful examination can the danger be averted of passing over something that is worth adding to the sum of accredited medical science.

Although the research laboratory and the hospital-clinic are the most fruitful fields in which to discover new therapeutic principles and to determine their applications, it is a fact that sometimes, by chance or design, outside their ambit in the field of general practice and even in non-medical walks, something of true and permanent value is evolved. One need not remind the reader of the magnificent contributions to cardiology of Sir James Mackenzie, worked out in the course of general practice.

A lively curiosity and an open mind should form the basis of all scientific endeavour. Only by examining all likely methods can the gold be separated from the dross, and those methods which are found to possess intrinsic value be added to orthodox medicine instead of being left for exploitation by the unqualified or by the downright quack.

Physical medicine generally has in the past suffered from this inanition on the part of the medical profession generally. True, the position has greatly improved and the subject has as a whole been adopted *in principle*. There is, however, room for vast improvement as far as its adoption *in practice* is concerned. It is to the support of the general practitioner that we must look for its ultimate wide-spread use in the many conditions in which it can offer such valuable preventive, palliative and curative benefits.

MANIPULATIVE SURGERY

By SIR MORTON SMART, K.C.V.O., C.V.O., D.S.O., M.D.

Manipulative Surgeon to H.M. The King

THE general principles and the beneficial effects of manipulative surgery when applied to correctly selected cases have been well known and recognized since the earliest days of organized medicine. This valuable therapeutic method, however, has, until comparatively recently, been sadly neglected by the profession and has in consequence remained a domain which the orthodox practitioner has feared to explore.

Manipulative surgery is a method of treatment employed in association with other treatment or as a preliminary to other treatment, and in general deals with local conditions of bones, joints, and muscles including conditions involving impairment of mobility, and displacement of structures. There are many pitfalls which can only be avoided by a sound knowledge of medical science and the experience founded on it; and to apply manipulative treatment indiscriminately is unscientific; the results may be helpful, useless, or positively dangerous according to the kind of case in which it is employed.

From a long experience of manipulating joints crippled by adhesions my conclusion is that, if adhesions are successfully freed, and, if this procedure is immediately followed by coaxing the joint through its range of movements in all directions, and by treating all the muscles of the joint efficiently by graduated muscular contractions, the end-result in every correctly-selected case will be complete restoration of function, both as regards range of movements and muscular power.

The main line of treatment of joint injuries has for long been regarded as being essentially based on *rest*, in spite of the knowledge that inflammation normally causes the production of coagulable lymph which is followed by adhesions, and that the binding together of parts during the formation of adhesions must be encouraged if the inflamed parts are unduly rested. This doctrine of " rest " received the unqualified support of the majority of the leading surgeons of the Hunterian period, who, although admitting that inflammation and its late effects caused serious dysfunction of joints, strenuously opposed movements of a joint while any sign of inflammation existed. They held firmly to the belief that rest would ultimately end in the recovery of the injured structures and the restoration of joint function if voluntary movements of parts were withheld while evidence of inflammation persisted, and were only encouraged when all signs of pain and swelling had subsided as the result of such rest.

Owing to the element of pain in injury, this treatment by rest was not unnaturally encouraged and supported by the average patient and so it came to be believed that, generally speaking, a painful and swollen part should be rested until all signs of pain and swelling had disappeared, no matter how long the time necessary might be. Thus the disastrous effects of the formation of adhesions, with their capacity to limit the range of normal joint movements, were not fully recognized and consequently as happens to-day this type of case drifted into the hands of the unqualified bone-setter, or his modern counterpart, the osteopath, and, although it was well known that permanent injury frequently followed their manipulations, it was equally well known that many cases were successfully treated. But in the cases thus successfully treated the generally accepted explanation that the " cure " is dependent on replacement of a

displaced bone is fallacious, the more correct explanation being that adhesions have been successfully freed. But much prejudice still exists in spite of what has been achieved by the application of scientific principles, and the unfortunate result is that those whose work to-day lies in the field of manipulative surgery know only too well that there are countless cases partially or permanently crippled by adhesions which could be cured or alleviated if they were given the opportunity of skilled manipulative treatment.

Definition and Basis of Manipulative Surgery

Manipulative surgery may be defined as " the art of manually moving a joint throughout its full range of movements in all directions with the designed object of overcoming resistance to its normal movements arising from certain pathological causes."

Manipulative surgery is based on three main essentials :

(1) A sound knowledge of the anatomy, physiology and pathology of joint structures :
(2) A knowledge of the normal range of movements of all joints :
(3) A capacity to diagnose as accurately as possible the probable pathological causes of interference with the normal range of joint movements.

From this knowledge and capacity combined with constant practice in handling joints in health and disease, it is possible to develop an acuity of touch essential to success in manipulative surgery. Generally speaking the type of case most amenable to treatment by manipulation is that in which the main pathological cause of interference to joint movements is the presence of adhesions. The various complicated structures that form the joints of the body each and all have an important part to play during joint movements and, by their arrangement and action, the special movements for which a joint is designed are performed painlessly and with the least amount of friction.

Joint adhesions may be intra-articular or extra-articular, or both may be present in the same joint, and bands of fibrous tissue of varying length binding two or more surfaces of a movable part such as a joint may become lengthened by constant stretching. Such bands cause grave disability of a joint, and the constant irritation set up by attempted movements leads inevitably to loss of function and chronic synovial inflammation with a collection of fluid in the joint sac, which in its turn results in serious and often permanent damage to other structures of the joint.

By the mechanical interference with the blood supply caused by adhesions in muscles and other soft structures, changes in their histological elements in time result.

Pain which generally precedes and accompanies the formation of adhesions is also a factor in promoting adhesions, because it encourages the painful parts to be kept still so that the opposing inflamed surfaces are kept in contact while the exudate passes through the various changes leading to organization, and later, when contraction follows, further crippling of the joint occurs.

In joints with a loose capsule, which is essential in joints with a wide range of movement, adhesions form quickly between the capsule folds, and any movement tending to open out the adherent capsule causes a degree of pain which further restricts the range of movement by setting up severe muscular spasm.

Extra-articular adhesions are adhesions outside the capsule of the joint and occur in the muscles and their sheaths, tendons, fasciæ, and particularly the fatty pads filling the spaces around joints, such as the infra-patellar pad of the knee-joint. They also occur in the delicate areolar tissue which fills up all the many spaces between, and in, the different structures of a joint.

The interference with the range of moving parts resulting from any structures of a joint becoming adherent to each other or to neighbouring structures even to a slight degree can easily be visualized, when it is remembered that, for a joint to move comfortably and easily through its full range, every structure designed for movement must be capable of free and painless movement on every other structure to which it is adjacent.

When muscles are atonic and wasted the effect on a joint which they normally operate is to prevent its free and painless movements. Before treating such wasted muscles, manipulation of the joint may be a necessary prelude, as such a condition of muscles, particularly over an extended period, is generally accompanied by malnutrition and loss of flexibility and suppleness of the areolar tissue due to interstitial oedema. This condition is also frequently accompanied by adhesions. Gentle daily manipulations of such a joint stretch the parts and, if active movements follow, either voluntarily or as a result of artificial electrical stimulation designed to cause controlled painless muscular exercise, movements become easy and painless since the tissue oedema is gradually eliminated and the formation of adhesions will be prevented unless these have already taken place.

When a joint is limited by adhesions the line of treatment should be decided by an estimate of the strength of the adhesions and the extent to which the structures are involved, and it should be a fundamental rule that no joint should be manipulated until every detail of the case has been carefully examined in a routine manner. After such examination it has to be decided whether to manipulate the joint under an anæsthetic, with a view to freeing adhesions as extensively and as rapidly as possible, or whether, by carefully designed active and passive movements over a period, complete freeing of the adherent structures is probable.

It should always be borne in mind that manipulation is a preliminary procedure to other treatment designed to encourage as rapidly as possible absorption of lymph, increase of the local arterial, venous, and lymphatic circulations, restoration of tissue nutrition generally, and the encouragement of function. Since freeing adhesions causes a subcutaneous aseptic wound with oedema and the other sequelæ of inflammation, the after-treatment is also designed to keep the inflamed parts moving in relation to each other, so that further adhesion-formation is reduced to a minimum.

Many joint cases, which have been quite properly manipulated, fail ultimately to recover because it has not been realized that manipulation is only a necessary preliminary to other treatment and that it is only possible to obtain the looked-for end-result by a combination of manipulation and well-designed after-treatment, based on sound physiological principles.

Routine Examination of a Stiff Joint

In the examination of a stiff joint every detail should be carried out in a routine manner, and every effort should be made to handle the joint in as gentle a manner as possible consistent with the object in view, not only in consideration of the patient's comfort, but because every movement which produces pain or causes anticipation of pain adds to the difficulty of differentiating between limitation of movement due to adhesions, or to muscle spasm.

The extent of the normal range of the corresponding joint would be estimated by careful examination of its movements in all directions as a guide for comparison. Inquiry should be made to discover if any restriction had been noticed in the faulty joint before the onset of the disability under examination.

Examination should be made for any points of tenderness to slight or deep pressure, and painful areas, when touched, moved or at rest, should be carefully noted, as they generally indicate the sites of underlying adhesions.

To estimate the degree and extent of restriction of movement the patient should lie comfortably on a couch and be encouraged to keep as relaxed as possible while the joint is being examined. Owing to anticipation of pain and the varying capacity of individual patients under the circumstances to lie relaxed, the tendency is to strain and so increase the spasm of the muscles and interfere with the examination. But, by training in careful handling of painful joints, it is possible to become expert in moving even the most painful joint with a minimum of pain, and gradually most patients will tolerate movements of greater magnitude than would be possible if the slightest roughness is experienced.

Having gained the patient's confidence and explained the object in view, the joint should be gently but firmly put through its movements in all directions of which it is normally capable and the degree and extent of its restriction in any direction estimated. Having noted that movement in certain directions is limited, a gentle but determined effort should be made to see if pain is caused by trying to force the joint beyond each point of limitation and to what extent.

If the effort to move the joint beyond its point of limitation causes pain increasing in severity in proportion to the strength of the effort, and if the pain so caused is lessened or relieved when the effort ceases, then it is practically certain that the resistance met with is due to adhesions. If on the other hand a joint can be manipulated so as to put it through the full range of its normal movements in all directions without pain, it may confidently be asserted that no adhesions are present.

In investigating for the presence of adhesions, it should be remembered that ligaments are not designed actively to support a joint but to limit its movements so that, when a normal joint is being stretched to its full extent, considerable tension can be applied to them. The normal restriction produced by a ligament at full stretch must be differentiated from that caused by adhesions. This point is doubly important when manipulating a joint under anæsthesia, particularly when adhesions restrict only the last few degrees of movement, since it is even more difficult under anæsthesia to decide if the limitation is due to adhesions or to the normal ligamentous restriction.

Adhesions, when stretched to the point at which they resist, have a characteristic "springy" feel which experience in handling joints soon teaches one to recognize. This springy feel is also somewhat similar to the resistance caused by muscle spasm or to that when adaptive shortening of muscles exists. A differentiation may be made by digital pressure over the muscle tendon, which may be felt to be slack or in a state of tension when the movement of stretching is performed.

The degree of irritability of spasmodic muscles can be gauged by the extent of their contraction response as felt by touch when the joint is suddenly moved to a point of pain; a highly irritable joint will cause a rapid and severe degree of reflex spasm easily palpable, while movements conducted gently and less suddenly produce a less degree of spasm.

In the examination of a joint, whether healthy, injured, or diseased, there should be no sudden or unexpected movement or sudden alteration of direction of movement, except when making the above test for the degree of irritability of spasmodic muscles. All jerky movements should be avoided, but the movements should be thoroughly and determinedly carried out, being at the same time smooth in action and conducted with gradually increasing power till the full extent of their range has been reached. The object of manipulating a joint may be said to be to put it through the widest range of movements of which it is capable in all directions without *the assistance or resistance* of the muscles which act upon it. When the point or points at which a joint is limited is gauged, gentle movements should be carried out within the estimated range, because as a rule when a joint can be painlessly moved within the range of the adhesions, the prognosis as a result of manipulation is better with regard to time and completeness

of recovery than that in which movement within the range of adhesions causes pain and severe muscle spasm.

When, as the result of manipulation, some adhesions are stretched but not completely ruptured either because the movements during manipulation were unintentionally or designedly incomplete, or because the natural limit of the joint was reached before the adhesions were sufficiently stretched to make them give way—the outlook is then not so favourable as when adhesions are felt to give way and the range of joint movement under the anæsthetic is immediately increased. Stretching adhesions without rupture is usually followed by severe pain which interferes with the after-treatment. If the pain persists even when the range of movements has been increased, it is generally advisable to perform a second manipulation fairly soon.

It has been laid down that, when a joint is restricted in movements in all directions, the joint should be rested and should not be manipulated, the argument being that limitation of movement in all directions usually means that the joint is, or has been, in a state of acute infective arthritis. If, on the other hand, movements are limited in certain directions only and normal in others, the assumption is that the joint may be manipulated with safety. It is my experience that, as the result of blindly following this rule, many joints have been condemned to long periods of rest which have only aggravated the condition and prolonged recovery, when skilful manipulation would have resulted in complete cure. The rule should be considered in conjunction with all other symptoms.

In arriving at a decision whether to manipulate a joint or not the following points should be carefully considered: (1) The history of the onset; (2) the degree and type of pain and tendency to muscle spasm; (3) the temperature of the joint; (4) the degree of limitation of movement; (5) the muscular wasting; and (6) the expert reading of good stereoscopic X-rays.

(1) *History of Onset.* The history of onset is important, because the stiffness associated with an infective arthritic joint makes its appearance gradually and progressively, while the stiffness resulting from traumatic adhesions usually develops much more quickly and follows a comparatively recent known injury.

(2) *Degree and Type of Pain: Muscle Spasm.* The pain in acute joint disease is more or less constant, much more severe and greatly aggravated by even slight movements particularly if suddenly carried out, while that due to traumatic adhesions is usually intermittent and less severe except during extreme movements. In acute disease movements in any direction usually produce pain, whereas a joint with traumatic adhesions although it may also be painful when moved in any direction generally, is not, and as a rule, shows that there is a greater degree of pain when it is moved in one or two particular directions than in others. An important point when it exists is that, in traumatic adhesions, it is often possible to move the joint to a considerable extent in several directions within the range of the adhesions without pain, pain only being elicited when a point is reached at which the adhesions become dragged on by the movements. The pain of adhesions is mainly caused by their being pulled upon so that the patient soon learns to avoid pain by limiting his movements, with the result that the unused muscles become toneless and wasted and the antagonistic muscles become spasmodic and ultimately shortened. Such tonic spasm may take place to a severe degree as may also adaptive shortening, and after manipulation may, owing to the difficulty of overcoming it and the severe degree of pain it causes, greatly retard progress. Active or passive movements of any adherent joint increase the pain which, if due to traumatic adhesions, settles down much more quickly after ceasing the movements than when due to acute arthritis.

Pressure usually elicits pain over the seat of adhesions but, in acute joint disease, the type of pain is generally more severe and not so localized, and the skin may be acutely painful even to light touch over a wide area.

Pain during sleep which usually wakens the patient in the early hours of the morning is one of the most constant and disturbing symptoms of adhesions, as the sleepless nights in time have a serious effect on the patient's general condition. This symptom is so constantly present that the most probable explanation is that it is due to the relaxation of the muscles during sleep allowing the adhesions to be dragged on and so irritated, while during waking hours the muscles are more or less on guard to prevent or limit such drag.

(3) *The Temperature of the Joint.* In acute disease the temperature of the joint is generally raised, but in a joint with traumatic adhesions there is usually no change, except in long-standing cases when, if there has been much chronic effusion into the peri-articular tissue, the surface temperature may actually be less than normal.

(4) *Limitation of Movement.* The most obvious sequel to the formation of adhesions in a joint is limitation of movement, and it is the correct gauging of the extent and degree of such limitation and the decision as to whether it is due to adhesions or other causes that constitutes the art of manipulative surgery. The most expert handling of a joint is essential when the adhesions are so slight that only a small range of joint movement is interfered with, and a most systematic investigation is necessary to differentiate between adhesions that may safely be freed by manipulation and those that should not be manipulated.

As muscle spasm is usually present to some degree in a joint with adhesions, and as this spasm is so often increased by any effort to move the joint, this increased spasm adds to the limitation of joint movement. By constant practice in handling both diseased and healthy joints a dexterity may be achieved by which a joint with adhesions and acute muscle spasm may be moved so skilfully that practically all muscle spasm is eliminated and the extent of the limitation caused by the adhesions alone can in consequence be estimated sufficiently accurately to enable one to decide the prognosis from manipulation. There is no difficulty as a rule in diagnosing adhesions where the limitation of movements is obvious but, where the adhesions are so slight that only the last few degrees of movement are interfered with, unskilled and cursory examination will fail to discover them. It is mainly in such cases that the bone-setter or osteopath obtains successes and it matters little to the patient who may be relieved by their administrations if the osteopathic pathology is open to question.

(5) *Muscular Wasting.* When a muscle's elasticity, contractility, and irritability are normal, that muscle may be said to be in a state of tone, that is, it is in a state of attention to respond immediately to a physiological stimulus. The immediate result of loss of tone is that the muscle is not capable of its full normal contraction and mechanically is placed at a disadvantage with regard to its capacity for work. This is an important factor because the rate of supply and the amount of nourishment brought to a muscle depend upon its requirements as measured by activity.

The importance of loss of tone and muscular wasting which so rapidly follows injury to muscles or any of the structures which form a joint cannot be overestimated. That many joints which have been manipulated for adhesions have failed to recover the full function anticipated, is due in nearly every properly-selected case to failure subsequent to the manipulation to obtain restoration of full function of the muscles normally acting on the joint.

PHYSIOTHERAPY IN FURUNCULOSIS

By DR. JEAN MEYER

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WE have, since 1926, made several reports on this subject and we consider that the indications for physiotherapy are well-defined.

We make use of three kinds of physiotherapeutic agent; ultra-violet rays advocated by Kromayer, and in Great Britain particularly, by Humphris; X-rays, first tried by Morton in 1903, and taken up again in France by Solomon, in 1927; and short waves, applied to inflammatory conditions in 1929 by Schliephake.

A priori, the medical practitioner is not tempted to employ physical methods. Antiseptic agents given hypodermically, vaccines and particularly the new Pasteur Institute vaccine (Ramon's anatoxine) give rapidly successful results in a high proportion of cases.

Among badly responding cases, are the diabetics and hypoglycæmic subjects who do not show glycosuria; these are resistant to all kinds of treatment if appropriate dietary or, if necessary, insulin is not prescribed. We would also limit the indications for physiotherapy to cases in which the latter is definitely superior to other methods. To submit to physiotherapy all cases of furunculosis is to ensure excellent statistical results but is otherwise uninteresting. From a practical point of view, patients object to the systematic use of complicated, and costly methods, in these simple cases.

We advocate two groups of indications, namely, recurring types and severe types. The severe cases are those of furuncles and carbuncles with involvement of the fascial planes, which may be complicated by cavernous sinus thrombosis, and septicæmia; extensive carbuncle of the neck, and in general cellulitis or furunculosis which are exceptionally painful or extensive.

The treatment of these consists in the use of X-rays and short waves.

X-Rays

One treatment alone is sufficient to check the development of a furuncle or carbuncle; some authorities employ the penetrating rays well filtered with copper; some authorities, however, employ a semi-penetrating apparatus, 100-150 kilovolts, filtered with 1-5mm. of aluminium. The dose is always very moderate, and varies according to the radiologist, between 10 and 200 *r*, but generally about 100 *r*. It is important to irradiate an extensive area well overlapping the inflamed zone.

X-rays do not act instantaneously; everything depends on the stage of the condition. With a malignant carbuncle, with severe progressing inflammation, relief is only obtained after 60 hours when pain diminishes and the temperature falls, even before the pus is discharging. It is necessary, however, to warn the patient that there will be no relief the day after treatment.

On the other hand, very painful but moderately inflamed furuncles may be checked in 24 hours and the pain rapidly diminished.

It sometimes happens that X-rays inhibit suppuration, but this is rare. They reduce inflammation and pain, facilitating the evacuation of the core and of pus, and hasten the cure, without, however, altering the normal course leading to elimination of the slough.

It sometimes happens that, within three days, relief occurs but remains incomplete; in such a case further treatment is called for.

In the dangerous types, for example, furuncles of the lips with œdema and fever, it is wise not to confine treatment to X-rays, but to associate with this the use of antiseptic powders and an injection of a vaccine, capable of provoking shock.

The additional use of bacteriophage which calls for injections into the inflamed area, seems illogical; one must chose between the two methods.

Short Waves

Short-wave therapy has the same indications as X-rays. Schliephake attributes to them an equal efficacy, but, in our opinion, they act less energetically but more rapidly. We have employed them in two cases of furuncles or painful carbuncles which had not yet reached the dangerous stage, and also in progressing carbuncles, with or without the associated use of X-rays. Each of these two methods should not be employed on the same day, since such a procedure leads to severe congestion of the infected area.

One electrode is placed on the infected area to cover it, and the other is placed some distance away.

The wave-length matters little provided that suitable electrodes are chosen and placed in position according to the requirements of the case. We have obtained the same good results by using 7 or 16 metres, but the techniques of use are appreciably different.

The intensity is always moderate, particularly when the lesions are most acute. Schliephake insists very reasonably on this point. The duration of a treatment varies between 10 and 30 minutes. The treatment should induce and leave behind it a pleasant sensation.

Treatments are repeated every day, and sometimes two have been given on the same day, at the beginning of a difficult case. Relief does not become evident before the third or fourth day. In the case of a furuncle we expect to give two to four treatments; in the case of a large progressing carbuncle of the neck, we may have to give about a dozen treatments. The following are illustrative case reports.

(A). A progressing carbuncle of the neck in a man of 55, general condition poor; mitral disease; obesity; enlarged liver; intermittent glycosuria. The patient was seen on the fifth day. The treatment comprised, the first day an X-ray treatment of 100 *r* at 120 kilovolts, the radiation filtered with 5 mm. of alumini[redacted]two following days a short-wave treatment for 20 minutes. On the third day the carbuncl[redacted]read, but it was opened only by a straight narrow incision and there was little disch[redacted]erature fell to 99.5° F. We then gave a further X-ray treatment followed [redacted]reatments. The carbuncle cleared up; pain disappeared. The cure was completed by the us[redacted]and general ultra-violet irradiation.

(B) A carbuncle of [redacted] with severe œdema in a young man of 24; three days' duration, temperature 100.2° F.

We gave an X-ray [redacted]llowed at once by 3 c.c of a vaccine (propidon) subcutaneously. The temperature fell [redacted]and œdema diminished suddenly on the second and third night, about 6 hours after th[redacted]ment and injection. Pus was discharged during the evening only, so that the relief experienced could not definitely be ascribed to the evacuation.

(C) Diffuse carbuncle of the lower lip in a young woman of 19 of 5 days' duration. Diffuse œdema of the right cheek, extending up to the lower eye-lid. Temperature 104° F. One X-ray treatment was given followed immediately by an injection of propidon. The next day, signs of broncho-pneumonia appeared. Another X-ray treatment was given. Cavernous sinus thrombosis occurred, and the patient died on the tenth day. The carbuncle itself was cured. Thus, although broncho-pneumonia and a fatal thrombosis developed, the treatment effected disappearance of the carbuncle within the usual time.

Ultra-Violet Irradiation

Ten years ago we considered ultra-violet irradiation as the best means of treating furuncles. To-day short waves and X-rays have proved to be much superior. Ultra-violet, however, maintains certain local and general indications.

LOCAL APPLICATIONS. There are three indications.

Cicatrization of carbuncle lesions after the carbuncle has been checked by other methods. A treatment is given every second day, employing a moderate sub-erythemal dosage.

Resolution of the resisting cores of sclerosing furuncles by means of a single, very strong and strictly localized dose. We employ a polymetallic arc lamp with a filter, giving the maximum heat which the patient can tolerate. When a sensation of burning occurs the lamp should be lifted for a few moments and then replaced in position. The treatment lasts about 10 minutes. In 1926 we described this technique in detail under the name of actinocautery. We then employed it for all furuncles, but have now discontinued it, except in resistant forms.

Regional recurring furuncles. These affect a limited territory, for example the nape of the neck, the thighs, and the lumbar regions, and they last for weeks in spite of dressing.

Nothing is better than a few ultra-violet irradiations. The erythemal dose must be given, without causing blistering, over an extensive area, which considerably overlaps the affected region. The polymetallic arc lamp is preferably used. Practically every case responds in eight or ten treatments, given on alternate days. We have only rarely had to revert to X-ray therapy and have only experienced two cases in which ultra-violet did not produce a cure.

General Treatment

We consider that general irradiation has a specific action on furunculosis. This has, moreover, been recognized, especially by British workers.

We employ exclusively certain rich sources of ultra-violet, about 3,000 A.U., e.g., the carbon mercury-arc lamp or certain mercury-vapour lamps of recent type.

Treatments are repeated every other day, the whole body receiving irradiation. The patient does not lie down but stands before the lamp, or preferably between two lamps, so as to irradiate almost the whole surface of the body. The dose is determined by the sensitometric test of Saidman (the test is made on a small surface of the skin by means of a special apparatus), and is rapidly increased to reach [illegible]erate erythemal dose.

Generally, the attacks of furunculosis rapidly become [illegible]runcles come to a head quickly. The last furuncle appears before [illegible]day. A cure is obtained in 25 days with about 12 treatments, a lesser n[illegible]treatments often being sufficient. It is sometimes useful to combine with alt[illegible]erapy, shock therapy by means of an injection of vaccine or the use of auto[illegible]y, but not before the ultra-violet has caused a general improvement, or not[illegible]enth day.

The action of ultra-violet light is difficult to define[illegible]t place it transforms the general state of fatigued, emaciated patients, rapidly causing [illegible] markable sensation of well-being. Eidinow has shown that preliminary irradiation inhibit experimental staphylococcal septicæmia in the rabbit, although [illegible] later inoculation of staphylococci, irradiations increase the percentage of [illegible]. We believe that one can compare, from this point of view, furunculosis and [illegible]. Only the forms with favourable reaction of the body, respond to ult[illegible]. On the other hand, progressing furuncles, without sufficient bodily d[illegible]e aggravated. The esophylaxines theory of Hoffmann, who admits the possibility of an anti-tubercular

Continued at foot of page 82.

PHYSIOTHERAPY and ORTHOPAEDICS

PART IV

BY W. SAYLE CREER, M.CH. (ORTH.), F.R.C.S.

FASCIITIS

LUMBAGO is usually regarded as a medical condition. It is a fibrositis or fasciitis affecting the lumbar muscles. In certain cases it takes the form of a frequent mild ache whenever the patient is tired. Of these, a proportion are young, thin, rapidly-growing or anæmic girls with long, slender backs, while in others no cause or reason can be discovered. The single or occasional severe attack type causes the patient to lie like a log in bed because the slightest movement gives rise to excruciating pain. It is questionable whether these cases should be included in this section, but it is a convenient place to discuss them.

The mild type require a course of massage and physical exercises to increase muscle power and to improve posture, combined with daily periods of physical rest and a less strenuous occupation if possible. The true lumbago is usually treated by putting the patient to bed with hot water bottles and aspirin till the pain is easier. After this, those who can afford it, receive massage and heat privately at home, while the hospital patients linger on for several days more till they can get down to hospital. This treatment is effective, but time would be saved if all the patients were manipulated under anæsthetic at the commencement of the attack. The relief of pain in most cases is instantaneous, but it is a wise precaution to order physiotherapy for a few days.

Allied to, and often associated, with lumbago is sciatica. The rôle of physiotherapy in this condition is changing just as assuredly as in the case of lumbago and of fractures. After one has made certain that the sciatica, which after all is only a symptom and not a disease, is not due to disease of the spine, prostate, uterus, etc., the spine and hips are manipulated and the sciatic nerves stretched. This treatment, which may have to be repeated on several successive days, is followed if necessary by heat and massage. But to start with heat and massage without a manipulation is equivalent to putting the cart before the horse.

Another of the many types of back pain is that associated with an abnormality or deformity of the hip-joint. It is surprising how often one is sent a patient who has "a backache which does not seem to respond to massage," who on examination is found to have an ankylosed or deformed hip, or both, or a short leg, or who has had a high thigh amputation. In all these cases the pain in the lumbar spine is due to (1) an exaggerated lordosis due to flexion deformity; (2) lateral deviation caused by a tilted pelvis due to a short or amputated leg; (3) the abnormal compensatory movement required where the hip is ankylosed; or (4) a combination of all three. In each case a secondary or traumatic arthritis develops and is maintained by the original condition. There are no more tragic cases than these, for it is rare to be able to remove the original cause, and all that can be done is to advise the continuance of physiotherapy knowing full well that it will have little or no effect.

Tennis elbow is a rather foolish name though convenient. In an industrial area one finds that the majority of cases are not due to tennis, but to some occupation involving repeated movements of the arm with strong grasping. The pain is present over the external condyle of the humerus when the forearm is actively supinated while grasping, or can be elicitated by passive palmar flexion of the wrist, pronation of the

forearm and extension of the elbow, which stretches the supinator muscles at their origin. Tenderness is present at the same site. A few cases are due to radio-humeral arthritis, as can be proved by operation, when hypertrophied synovial fringes will be found between the head of the radius and the humerus.

The former group responds to different forms of treatment depending on the stage of the case. The pathology is the rupture of a few muscle fibres or the formation of an intramuscular exudate. In the early stages rest from the exciting cause, firm strapping and infra-red rays are needed. Some of the late cases will respond to the same treatment. But a dramatic cure can nearly always be obtained by a manipulation under anæsthesia. The majority of surgeons are content with this alone, but in my experience it is better to follow the manipulation by a short course of radiant heat or infra-red rays, kneading, and faradic stimulation of the painful area. Failures, if the diagnosis is correct, are few.

JOINTS

Simple contusions of the knee-joint are intensely painful. Even after the first few minutes of agony have passed the patient is reluctant to move the joint for a week or more. An effusion develops and the quadriceps muscles waste. After two or three weeks' rest the effusion subsides and the patient gets up apparently cured. To his and his doctor's disappointment the effusion returns and back he goes to bed for further rest. On getting up the same experience befalls him. The cycle may be repeated several times before further advice is sought.

An analysis of the findings and the history, and some little thought, reveal the reason and the cure. After the contusion an effusion forms as the natural [illegible] reaction. Once an effusion has occurred in any joint, its return is facilitated by changes in the synovial membrane. The second natural result of the joint injury is a reflex wasting of the muscles controlling the joint, which in the case of the knee, applies particularly to the quadriceps. The rest in bed allows of the added wasting of disuse. When the patient starts to walk the weakened muscles fail to control the joint fully, and repeated small jars due to stepping awkwardly produce a further effusion. There is only one treatment which will cure this, and I have never known it to fail, even though the case has been hanging on for six months. The quadriceps muscles must be re-developed by exercises. Of course massage and faradism will help, but alone are a waste of time, because they cannot be given for more than twenty or thirty minutes daily. Static quadriceps exercises as described for the after-treatment of cartilage operations, can be practised by the patient for a few minutes every hour of the day, and these, and these alone, will cure the most obstinate case inside two weeks.

Contusions of the shoulder follow falls on the hand, e.g., with a Colles's fracture of the radius, or a fall on the joint itself. In the latter case there is often severe pain from the start, with consequent limitation of movement. The arm must be rested in a sling and the shoulder gently massaged and given heat baths. A determined attempt must be made to get the patient to put the joint through *one complete* range of movement each day in order to prevent adhesions forming. The best way to do this is for the masseuse to take the weight of the limb while the patient is lying down, and to assist him or her to make the movement. In those cases following a fall on the hand it is common to find that there was little or no pain at first and that the patient did not realise there was anything the matter until two or three weeks later. Then, being able to use the arm because the wrist was improving, he or she discovered that movement of the shoulder beyond a small range caused pain. In a well organized fracture clinic the regular *whole-arm exercises* from the commencement would have prevented

MEDICAL AND SURGICAL DIATHERMY

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Continuing the Series of Papers on

ELECTRO-MEDICAL APPARATUS : ITS CHARACTER, OPERATION AND CARE. PART II. No. 8

WE have observed previously that, although the name " high frequency " has become associated in English medical usage with small induction coil apparatus chiefly for simple " violet-ray " work, the term actually describes currents employed in diathermic, short-wave and other applications of rapidly-alternating currents to therapeutic and surgical work.

In passing it may be recalled that so-called " high-frequency " apparatus includes that whereby current is passed to the patient with the help of glass electrodes and often accompanied by showers of thin sparks. This apparatus generally operates at high voltage and not infrequently with Oudin unipolar technique.

MEDICAL DIATHERMY

In medical diathermy the current is passed through the body by means of metal electrodes applied to the part requiring treatment. The electrodes are backed with felt or rubber pads to assist uniform and firm contact between the skin and the electrode metal. The voltage employed in this work is comparatively low and the frequency of the order of 100,000 to 1,000,000 cycles per second, i.e., corresponding to wavelengths of 3,000 to 300 metres. Perhaps the commonest form of electrode consists of tin or lead foil cut to size and shape according to the area to be treated. The foil is about $\frac{1}{2}$mm. thick and is pliable enough to conform to the contour of the part to which it is applied. Electrical contact with the electrodes is made with special clip-on terminals or by binding the ends of the conducting leads from the diathermy machine to the foil sheets with rubber or leather bands.

A number of special electrodes are employed. These have certain mechanical advantages over the simpler " cut out " ones in that they are easily handled and may be used repeatedly. They are generally specially shaped to be adapted to particular parts of the body and render assembly and removal of the electrodes very convenient.

In one of these special forms of electrodes the metal is divided up into a number of small plates connected electrically together and giving great flexibility. In another specially formed plates are built into a box-like structure devised to be strapped round the trunk.

The areas of the electrodes depend naturally upon the part to which the current is required to be taken, thus for, say, a knee, two electrodes each of about 12 square inches in area may be used, while for abdominal locations, electrodes of 100 square inches may be required.

General increase of body temperature up to 104°F. may be produced by the use of large electrodes placed, for example, on the abdomen and back, while local temperatures up to 112°F. have been obtained on internal organs when it is possible for an electrode to be in contact with or near them as is the case with pelvic work.

Fig. 139 indicates how current distribution is partly dependent on electrode size. Currents varying from 500 m.A. to 4,000 m.A. are used. The value, which is a function of machine output and electrode area, must be governed by the physical reactions, temperature rise, etc., of the patient.

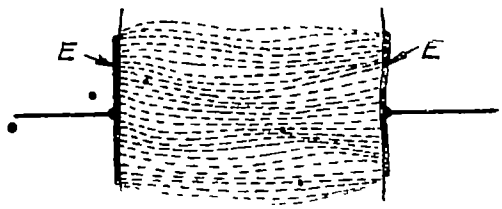


Fig. 138.—Diagram showing a possible distribution of current between electrodes (E E) applied to the body. Irregularities in current density suggest the various conductivities of different organs.

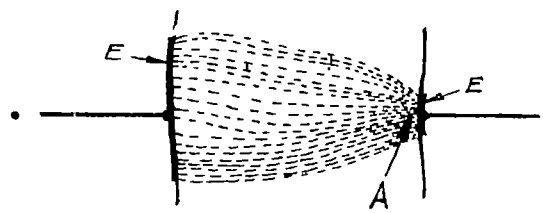


Fig. 139.—Diagram showing a possible distribution of current between a large and small electrode (E E) applied to the body. Note comparatively high current density at A.

If, with a given current, a high density is required locally, at a point A, for example, Fig. 139, large and small electrodes may be employed as shown. Actually the distribution of current in the body is a very complex one since such a variety of solid and liquid components make up the current's path. Bones and fats represent the high resistance components while fluids in the body are generally of low resistance. When high and low resistance paths are in series the same current passes through each and the high resistance parts tend to become hotter since temperature rise is proportional to resistance.

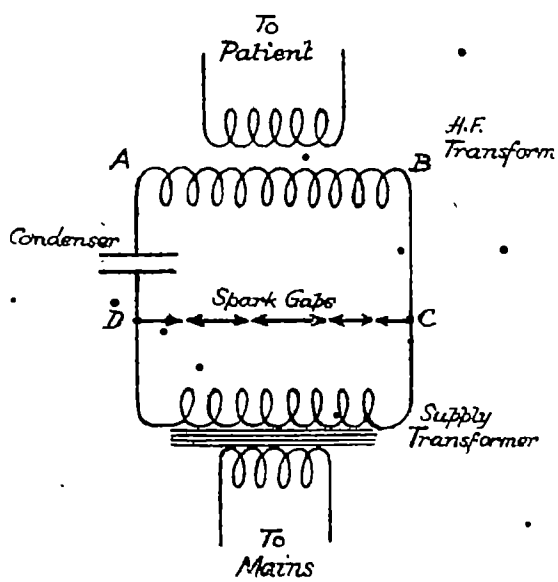


Fig. 140.—Simple circuit for applying diathermic currents to patient. A.B.C.D. is the primary oscillating circuit.

A point to remember is that, although heat may be generated in a particular region by the action of the current, the blood stream in that region is conveying the heat away. This effect is, of course, most important when large blood vessels form part of the current-carrying region.

In order to avoid burning of the skin at the edges of the electrodes the sharpness may be got rid of by turning them back to a radius of a few millimetres.

Medical diathermy treatment may be given with spark-gap or valve-type apparatus. Valve apparatus is capable of higher power outputs since there is no limitation from the use of a spark-gap. A large number of spark-gap-type machines are still successfully employed for this type of work. A diagram of a general form of circuit for a spark gap type medical diathermy machine is shown in Fig. 140.

SURGICAL DIATHERMY

Since the name " diathermy " suggests the idea of " heating through " it is less appropriate to the application of high-frequency circuits to surgical work than it is to their application in the medical sphere. A better name " electro-surgery " has been proposed.

be used for the cold, congested extremities, so common in nerve lesions. A cheap and simple form of the contrast-bath consists of two buckets of water, one hot and one cold, into which the extremities can be plunged alternately; used nightly this is valuable in restoring tone to weak intrinsic muscles of the feet or hands.

The contrast-bath and douche are very valuable for soothing the tinglings and other forms of abnormal sensation which accompany the process of recovery in peripheral nerves after they have been sutured, or even bruised, e.g., the brachial nerves after reduction of a dislocation of the shoulder.

Heat in the form of baths is unsuitable for certain types of nerve disease in which slowly healing trophic sores have formed, or in which the skin tends to be sodden. Dry heat is more suitable for such cases.

Dry-Heat

This is available in many forms, of which the following are widely employed :

(a) *Radiant heat.*—This should always be applied before massage to any part, especially the cold limbs of paralysed cases. The simplest form of providing it is by means of a very hot blanket, or a gas-stove, but the various types of cradle with electric bulbs are more convenient. Where electricity is not available, a wooden cradle over the patient can have its interior raised to a great heat by a pipe led from over a small spirit-lamp. Heat of this type is very valuable for the stiff joints which follow splinting (e.g. in plaster-of-Paris), often a necessary part of the treatment of nerve cases, particularly those that have been submitted to operation. Though the stiffness is usually transient, in certain cases it seems to be of a definitely arthritic nature and is hard to overcome, particularly when weakness of muscles prevents the patient from giving the joint constant movement.

(b) *Infra-Red lamps* seem to be becoming more popular for applying heat to localised regions, and the comparatively deep penetration of the infra-red rays no doubt induces a better circulation in the skin, which must help joints and muscles alike.

(c) *Diathermy* for inducing deep heat in the stiff joints and adherent muscles, which often accompany nerve disease, is a valuable form of treatment; but extra care in its use is necessary in such cases, for their anæsthestic condition renders them insensitive to burns, so that there is no early warning of that danger.

Light Radiation

Patients with nerve disease are often in poor general health, the latter being sometimes the primary cause of the disease and sometimes the result of enforced want of exercise and confinement indoors. Accordingly, ultra-violet light in the form of general light baths is useful. It is also useful locally in weak doses for stimulating healing in the common trophic sores and for improving the circulation in fingers and toes subject to chilblains.

Natural sunlight can be used for the same purposes, it again being remembered that the patient may be insensitive to the heat rays and that the skin may be irritated by the ultra-violet rays, so that tiresome blisters may form unexpectedly and may leave sores which heal very slowly. Many cases of poliomyelitis and of chorea have a marked *tâche cerébrale*, i.e., the skin capillaries dilate in response to light mechanical irritation or heat, and do not constrict again for a long time, so that, for example, one can write with the finger on the patient's skin and the letters stand out for a long time in red wheals.

Cold Air

Cold air in contact with the skin of the whole body, such as usually accompanies sun-bathing, is a valuable stimulant to the body's metabolism, but must be used cautiously in these patients for the following reasons. Chilblains on the extremities, and even gangrene of digits, readily develop, so that, if such patients are treated in

open-air hospitals, they must be watched at night, and provided with hot-bottles, or preferably with sleeping-bags. It is actually best if they can sleep in a closed ward.

Electrical Stimulation

Stimulation of muscles and nerves by electricity is commonly considered the most important form of physiotherapy for nerve diseases. Such, however, is not the writer's experience, in spite of working in hospitals equipped to give every form of such treatment. The leading orthopædic surgeons in many countries take the same view that the value of direct electrical stimulation is very restricted and its use often dangerous. In this connection one must remember that the patient's own use of recovering muscles is limited by "fatigue," which is really an inhibition in the central nervous system itself, by which certain tracts are cut off from undue stimulation. The electric current pays no attention to these natural barriers and forces its way through closed doors, so that it may kill off, by causing excessive fatigue, nerve-cells which were hovering between life and death. No masseuse would like to think of herself as a "murderess," yet no doubt many are walking around haunted by the ghosts of the nerve-cells they have "put on the spot!"

Children suffering from poliomyelitis and spastic conditions are usually very nervous and emotional, and any possible physical benefit is not commensurate with the mental upset caused by the use of electric currents. The only case for which faradism is occasionally essential is after a tendon-transplant, in order to demonstrate to the patient that the limb can be moved in the required direction by the recently transplanted muscle. The same is occasionally true after nerve suture, when the patient, after months of paralysis, fails to discover that regeneration of the nerve has restored communication between his brain and some special muscle. Faradic response is seldom obtainable in the recovery after poliomyelitis, nerve suture, and peripheral neuritis until voluntary power has been present for some time, so that careful re-education of such power by the masseuse is more useful than any electric current.

Galvanic and sinusoidal currents will induce contraction of muscle fibres when voluntary power is absent, and some observers are convinced that they maintain the nutrition of the muscle fibres until the brain can regain control over them. This is a matter which is very hard to prove, but it seems a reasonable proposition, as we know how much the peripheral circulation and lymph flow depend on the action of muscles. If time is limited, the use of electricity should not be allowed to exclude other methods of improving the circulation.

Manual Massage

From time immemorial the human hand has been found to provide one of the most valuable forms of treatment for paralytic conditions, and, for its proper use, training, experience and the personality of the worker are of primary importance. In the writer's experience no other form of physiotherapy is a substitute for massage and none is of greater value.

In dealing with nerve conditions massage has three aims:

(a) *Improvement of the circulation.*—To obtain this, massage may have to be restricted to gentle stroking, if there is sensory irritability, as in recovering peripheral neuritis and poliomyelitis. Deep kneading assists the lymph flow and stimulates muscles, but must not be allowed to fatigue the latter. As already remarked, the benefits of massage are greatest, at least in the case of a blue, cold limb, if it is preceded by heating of the parts.

(b) *Loosening of Adhesions.*—Adhesions of soft parts to one another and to bones can be loosened by moving the tissue planes one on another and by pulling tendons sideways. Another valuable manœuvre is to get the patient to pull a tendon upward, while the operator pulls the skin and tendon sheath downward, and *vice versa*, thus

getting rid of adhesions in a manner which would be impossible under anæsthesia, during which the patient could not co-operate.

(c) *Stretching of shortened muscles and joint capsules.*—This must always be done with the patient pulling in the same direction, so that the short muscles relax to their maximum by reflex synergic lengthening, which is a part of the system of reciprocal innervation of antagonists, on which all muscle action is based. If this precaution is not taken, the patient will resist and voluntarily shorten the very muscle the masseuse is trying to lengthen; if the masseuse wins the tug-of-war, it will probably be at the cost of torn muscle fibres, whose healing will increase the scar-tissue and contracture.

Gymnastic Exercises and Apparatus

Exercises can play a valuable part in the treatment of convalescent nerve cases, but their use requires judgment, and the simplest apparatus is generally the most valuable.

Simple weights and pulleys are amongst these useful apparatus. They can be attached to a limb by a simple webbing cuff and buckle, and used to stretch contractures, or merely to resist the stronger muscle, whilst its weak antagonist is exercised. For example, with the patient prone, a weight attached to the ankle will assist the quadriceps to straighten the knee towards the floor (with gravity) and to stretch tight hamstrings. With the patient supine and pulley high, the weight will help the quadriceps against gravity. The use of these pulleys demands considerable ingenuity, but there is hardly any muscle in the re-education of which they cannot be used.

The more elaborate forms of the Zander apparatus are not more effective, and their use is generally time-taking, so that, in the writer's experience, the time is more profitably given to hand-massage.

In regard to exercises of the trunk muscles, a reminder may be given that they, like other weak muscles, should first be trained with gravity, i.e., in the supine position, then in the neutral position, e.g., hip-shrugging to contract the lateral abdominals without weight-bearing; the load should then gradually be increased. For the trunk this means the *prone* position next, when only the head and shoulders are loaded on them; then the *kneeling* position, for which the whole series of Klapp's crawling exercises are most valuable. Although this principle is widely applied to limb muscles, it is almost as widely neglected in regard to the trunk.

Forcible Manipulation under Anæsthesia

Forcible manipulations are particularly dangerous in cases of nerve disease, in which there is a great tendency to atrophy of bone; it is accordingly easy to crack these brittle bones, and re-union is rather slow. The fractures are generally green-stick, without much displacement, but the fixation necessary to unite them does not help to mobilise the joints, nor is the patient grateful for the extra pain involved. If nerve cases are treated on sound lines from the onset, so that strong muscles are not allowed to shorten and joints not allowed to stiffen (except for the minimum degree inevitable when plaster is used), no forced manipulation ought ever to be required in their treatment. Occasionally, they are associated with a tedious form of arthritis, and the weakness of the muscles prevents the patient from keeping the joint moving freely; in such an exceptional case, a cautious manipulation under an anæsthetic may be needed, but it should only be undertaken by an expert.

Occupational Therapy

One of the most valuable forms of treatment for nerve cases, though one much neglected in Britain, is occupational therapy, i.e., the training of hand and foot in activities, such as weaving, knitting, carving and fretwork. The training must be given by an expert who understands anatomy and the principles of disease. The

primary aim is the use of some particular movement, the beauty or utility of the article produced being of secondary importance.

There are many varieties of suitable occupation. Weaving has many grades and the looms also vary from a ball with axial strings, to the large hand-looms, formerly used in industry.

Knotting brings in wide stretching of the arms with extension of the elbow.

Fretwork adds activity of the lower limbs. A bicycle-type of fretsaw is useful, in addition to the ordinary ankle-type, as it adds wide knee and hip movements.

Chip carving is a light job. Athetotic cases can be taught to spell and read by alphabet blocks.

Having reviewed the main fields of physiotherapy, which are applicable to nerve cases, we may take a brief look at the chief groups of diseases for which they will be required.

TYPES OF NERVE DISEASES

In planning treatment for a nerve case, it is of vital importance to appreciate which form of nerve tract has been affected by the disease. Some diseases such as disseminated sclerosis affect several tracts with quite opposite functions, and in such cases treatment must be directed to the predominant lesion, taking care that it does not aggravate any.

The following types of central nervous function are affected by disease of certain tracts:

Upper Motor-Neuron Lesions.—Control by the higher motor centres is reduced so as to leave the limbs and occasionally the trunk spastic, i.e., badly co-ordinated contractions of the muscles on one aspect of the limb, usually the hip and shoulder adductors, and also the elbow and knee flexors, wrist flexors, finger extensors, and calf muscles. In these cases the control of the proximal joints is usually much better than that of the distal (digits); this is the converse of what occurs in poliomyelitis, where only the exceptional case loses use of the intrinsic muscles, while the shoulder, hip and knee are commonly weak.

The true spastic has a lesion of the pyramidal tracts from the motor cortex to the motor anterior-horn cells in the spinal cord, the level of the lesion varying. There is another type of rigidity, frequently seen in encephalitis lethargica (sleepy sickness), in which the limb stays fixed in whatever attitude the examiner places it; in this the disease has affected the basal ganglia of the brain. This type, instead of the more usual pyramidal type, sometimes follows birth-injuries.

Both these forms of rigidity yield well to the warmth and buoyancy of the deep-pool, which increases the patient's confidence in his power to control his limbs. Once the brain has acquired such control in water, it retains it on land. Such cases are rendered more rigid by the irritation of electricity and heavy massage.

Cerebellar Lesions.—In addition to diseases of the upper motor-neuron, such as the above, it it not uncommon to meet diseases of the cerebellar system, so that the balancing centres of the brain are upset. These cases can never be given normal control and some of them, especially the hereditary type, get steadily worse, in spite of the best treatment, but others improve considerably when they are taught to balance in a deep pool and, later, to walk between parallel bars towards a mirror, in which they see their defects. With these patients, as also in tabes, the aim is to teach them to substitute control of balance, through the eyes, for the missing joint-and-muscle-sense.

Birth-Palsies.—Certain patients with birth-palsies, in whom no spasticity nor sign of cerebellar lesion is to be found, appear to suffer from loss of "association areas," so that the mental processes of muscle-control take an undue time, resulting in a form of inco-ordination, which is very difficult to train. These patients can do any movement,

PHYSIOTHERAPY IN NERVE AFFECTIONS

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THE subject of physiotherapy is vast and the subject of nerve diseases, even the common ones, is wide, so that, when the two are combined in a short article, it is only possible to touch lightly on some of the more important points. The term " physiotherapy " has a different significance to different specialists and is not always understood by the lay public. It may include splints and various appliances which give mechanical support to paralysed parts, and even include operative treatment, whose success depends on mechanical re-adjustments; but in the present article these two great groups will be omitted.

It seems best to consider first the main types of physical measures by which the effects of nerve diseases can be relieved, or ameliorated, then to deal with the general principles of their application to such diseases, and finally to note briefly their uses, or limitations in special diseases.

TYPES OF PHYSICAL TREATMENT

Whatever the type of treatment prescribed, it should be recognised that its results depend very largely on the " man behind the gun " ; this factor is often overlooked by the administrators of institutions, who consider that to provide the most up-to-date equipment is to ensure the best results for the patients, whereas it is the writer's experience that the most efficient forms of treatment often demand quite *simple apparatus,* but a very high standard of *experience* and, above all, of that elusive factor, *' personality,"* in the staff. Indeed, the successful quack is quite right when he attributes his " miracles " to some inborn capacity in himself, though his successes would generally be more permanent and their percentage higher if he added a scientific training to his Heaven-sent gift.

Hydrotherapy

Water provides one of the most valuable weapons in the hands of the practitioner of physiotherapy and we know what importance the ancient Romans attached to it. Water may be employed in many forms, the most commonly employed being as follows :

(a) *The deep-pool.*—This was very popular in Roman times, and its value has been re-discovered within the last few decades. It has two chief functions, namely, by supplying heat it relaxes muscle-spasm in cases of spastic paralysis of the pyramidal-tract type, whether due to birth injury, or some form of " stroke," etc., or to arthritis associated with the nerve disease; and by supplying buoyancy it eliminates the effects of gravity on a weak trunk and limbs and so allows activity of partially paralysed muscles in a manner impossible on land; this in itself has the psychological effect of increasing the patient's confidence; it also encourages exercise of weak muscles, which otherwise have disuse atrophy added to their primary disability.

(b) *Douches.*—Douches provide a comforting type of treatment to the patient and the simultaneous application of heat and massage, which may either be of the light, skin-tickling type, as in the Vichy and Aix douches, or heavy so as to move deep congestion, as in the Scotch douche. In addition to the massage effect of the moving water, hand-massage by the attendant can also be given during the douche

(c) *Contrast-Baths,* alternating from temperatures of 110°F. to ice-cold, can be given in the form of douches; a very valuable form is the Scotch douche, which can

on alternate days. When the condition has become chronic, treatment will probably have to be more prolonged and as many as 36 applications may need to be given. Though there may be striking subjective improvement, this may not necessarily for some time be accompanied by objective changes, such as improved definition and clearness in the radiograms.

The benefit obtained by ultra-short wave treatment is generally lasting, but of course it is not possible to prevent re-infection. Care must, therefore, be taken to avoid colds and, if one should threaten, an ultra-short wave application should be arranged as soon as possible.

Technique. The treatment is most conveniently given with a valve apparatus, using the 6 metre wave-length; 10 cm. Schliephake electrodes are again used and treatment is applied antero-posteriorly, the anterior electrode being placed over the frontal sinuses when these or the ethmoidal and sphenoidal cells are affected, and the posterior electrode over the nape of the neck. Applications, at first, are of five minutes' duration, and this is increased gradually to 10 minutes. If the antra are affected, the patient lies in a comfortable chair with his back to the apparatus and the 10 cm. electrodes, attached to adjustable arms, are placed obliquely over each cheek, being closer together anteriorly. Treatment is at first of 5 minutes' duration and is increased subsequently to 10 minutes.

Radiant heat applications are also of great value in acute sinusitis and are applied in exactly the same way as for acute rhinitis.

Local Medication. Little need be said about the medicinal methods of treating acute rhinitis and sinusitis. The number of preparations available is very great. They may contain substances which anæsthetise the mucous membrane and relieve the local discomfort, but the disadvantages of using cocaine or its derivatives for this purpose are many, not the least being the risk of habit formation. Again, they may contain substances like menthol and eucalyptol which temporarily produce a feeling of freedom and coolness in the nose by stimulating the nerve endings which convey the sensation of cold; actually menthol after a time causes the nasal passages to become more occluded than they were previously; it has also been proved clinically to damage the ciliated epithelium of the nasal mucosa. Similarly, the use of substances such as adrenaline and ephedrine is of doubtful value, because they act by causing constriction of the capillaries and arterioles and of course, though they clear the passages, they interfere with the inflammatory reaction which is nature's way of combating infection. The use of a bland, inert, but soothing, substance, such as medicinal paraffin, has much to commend it; it can be best applied by means of a nebuliser or atomiser.

If nasal douches are used there seems a risk of spreading the infection to adjacent structures; this objection does not apply to the use of a fine atomiser spray with some mild antiseptic solution, such as glyco-thymoline, or to the use of an inhalation such as tinct. benzoini co. in hot water.

SUMMARY

To conclude, it is much more satisfactory to prevent the onset of colds than to try to treat them when infection has actually taken place. For prophylaxis, healthy living is of the utmost importance, together with ultra-violet irradiation during the winter months. When a cold is present, ultra-short wave treatment will generally cause it to clear up rapidly, provided the treatment is given at a sufficiently early stage of the condition.

The Present Status of Fever Therapy

L. T. Hall (*Jour. Iowa State Med. Soc.*, 1938, xxviii, 599) considers that the following diseases are improved by fever therapy; gonorrhœal infections, syphilitic infections, meningococcic infections, undulant fever, sinusitis, the arthritides, infectious chorea, ocular diseases, toxic infectious psychoses, multiple sclerosis, bronchiectasis, asthma, malignant tumours and kidney disease.

Sherman described in an article in the September, 1938, number of this *Journal* the results of the infra-red ray treatment of 947 patients suffering form "colds" in various stages.

The best results were obtained when treatment was given within 24 hours of onset. 25% of these were completely cured and 35% much relieved.

Of the cases which were given only one application, 20% were cured and 27% much relieved.

Ultra-Violet Irradiation. Another method which is of value is ultra-violet irradiation of the nose. This can be carried out with either a quartz mercury-vapour lamp or with a carbon-arc lamp, using iron-cored carbons. The author's nasal speculum, described in "Ultra-Violet Radiation and Actinotherapy"* allows simultaneous irradiation of both nostrils.

Naturally the nose must be carefully cleaned before irradiation is attempted so as to allow absorption of the ultra-violet, visible and infra-red rays to occur. The duration of the application depends on the strength of the lamp and on certain other factors, such as distance from the arc, etc., but an average dose is five minutes.

As has already been mentioned, the infection can spread from the nose to the accessory nasal sinuses, into the ear, and down the naso-pharynx into the larynx, trachea or bronchi. We are, however, here only concerned with involvement of the sinuses.

SINUSITIS

When sinusitis occurs, pain, often of a severe character, is generally a prominent symptom, the situation varying with the actual sinus which is affected. Infection of a maxillary sinus sometimes follows a cold and the antrum is infected through its orifice; in this case pain is generally felt over the cheek. If the orifice remains patent there is frequently profuse nasal discharge and there may be a rise in temperature. Infection of a frontal sinus produces frontal headache, the pain being spread over the whole of the sinus area which is tender to tapping. In ethmoidal infection, the pain is chiefly over the bridge of the nose and the sense of smell is markedly impaired. It is quite common for the sphenoidal cells also to be affected.

Treatment

Local Ultra-Short Wave Therapy. Ultra-short wave treatment is the most valuable method of dealing with sinusitis. Provided that there is free drainage from the affected sinus, the application has a soothing effect from the commencement and pain is relieved. If, however, there is enclosed pus which cannot find an outlet, the treatment may be followed after each of the first few applications by an increase or exacerbation of pain. The tension in the sinus is increased owing to the augmented blood supply. Absence of drainage, however, is not a contra-indication to ultra-short wave treatment provided that the possibility of a temporary increase of pain is explained to the patient who is willing to accept this risk. Another symptom which may occur is an increase in the amount of discharge, which sometimes becomes bloody. This increased discharge may be present after the first six or seven applications before finally subsiding. At first the treatment may produce a temporary feeling of giddiness but this passes off in a few moments and can be avoided by keeping the patient still for a few minutes after the termination of the treatment. It has been proved experimentally that it is possible to raise the temperature of the paranasal sinuses several degrees above the general body temperature. Marked relief and freedom from pain, which may be lasting, may follow 10 or 12 applications which can be given daily or

*Ultra-Violet Radiation and Actinotherapy. Russell and Russell. Edinburgh: E and S. Livingstone.

bacterial growth is fostered. These abnormalities are chiefly adenoids, deflected septa, polypi and enlargement or malformation of the turbinate bones. Care must, however, be taken to avoid all unessential damage to the mucous membrane. It must be remembered what an important air-conditioning apparatus the nose is. Dust and other mechanical irritants in the air lower a person's resistance to colds and in consequence colds are more prevalent among those who work in smoky, dusty, overcrowded cities.

Medicinal. Certain disinfectants can be sprayed into the nasal passages; such preparations as argyrol, 10 per cent., Seiler's solution, resorcinol 5 per cent., and glyco-thymoline can be used in this way. Inhalants such as tinct. benzoini co. in hot water may also be employed. Eye drops of colloidal argentum or collargol 2 per cent., which pass down the lachrymal sac and nasal duct, are also of undoubted value, especially in children.

Vaccines. The prophylactic value of inoculation by anti-catarrhal vaccines seems doubtful, though persons who have been so inoculated are less likely to suffer from complications.

Curative Treatment

Supposing that the patient, despite all preventive measures, is unfortunate enough to catch a cold, what treatment can be given? The treatment can be general and local.

Hydrotherapy. A sweating bath will often abort a cold. This may be given in the form of a Turkish bath or a foam sweating-bath; a steam bath with Wilde's pyretic couch or a mild pyrexia treatment with the Honsaker apparatus or some similar appliance for producing artificial fever; or the old-fashioned mustard bath.

We have frequently noticed that an artificial fever treatment given for some complaint of a more serious character has had the effect of curing a cold. This proves that the use of antipyretics is generally undesirable because Nature utilizes fever for combating infection in warm-blooded animals.

Frequent hot drinks of juices of the citrus fruits are of value and one drachm of essence of cinnamon, taken in hot milk three times a day, is another useful measure.

The patient should always be kept in bed if the temperature is raised, both for his own sake and for the sake of others.

Ultra-Short Wave Therapy. In regard to local treatment, the most valuable agent at our disposal is ultra-short wave therapy. If a cold is treated at its commencement, that is, during the congestive stage, before the condition has become catarrhal and before the swollen turbinates have occluded the nasal passages, one application of ultra-short waves will generally effect a cure. About ten minutes after the treatment has commenced, the nasal passages usually feel clear, it becomes possible to breathe through them without difficulty and the stuffy, uncomfortable feeling disappears.

The treatment is best given with a valve apparatus, using a 6-metre wave-length and the 10 cm. glass Schliephake electrodes. The patient sits in an armchair and one electrode is placed over the lower part of the neck and the other over the front of the nose. The metal plate in the posterior electrode is placed farther from the patient's body than the anterior one, a distance of 2½ cms. being usual. Treatment is generally given for 10 to 15 minutes; a comfortable warmth should be experienced. A second treatment given within the next 24 hours is often advisable as a precautionary measure.

Radiant Heat and Infra-red Rays. If ultra-short wave treatment is not available, infra-red rays or radiant heat can be used. The patient is placed in an arm-chair with the head resting comfortably on a cushion and the lamp is placed 12 to 36 inches away, the distance depending on its power. Treatment is generally given for 15 to 30 minutes. As seen in trans-illumination, the red rays have the greatest power of penetration; protective glasses should be worn whenever necessary. The application should be soothing and comfortable.

Both these factors would affect the loss in working days per employee. The number of working days lost in the previous winter of 1936-37, before the commencement of the experiment, was 2.12 for the controls and 2.25 for those receiving treatment. The author found that the number of working days lost per person was substantially reduced with ultra-violet irradiation and slightly reduced by vitamin treatment. It was an interesting fact that, though certain of the benefits resulting from ultra-violet irradiation are known to be due to the formation of vitamin D, the irradiation results were much better than those obtained from the oral administration of vitamin D, proving that ultra-violet irradiation produces other effects in the body.

The author summarizes his results as follows : " It was found that the only method of real value was ultra-violet irradiation, which reduced both the severity and the number of colds in patients so treated. The method is cheap and easily applicable to large numbers of employees. Its use by big industrial concerns would definitely lower the tremendous economic losses at present caused by the common cold."

Experimental work at Cornell University, New York. Maughan and Smiley of Cornell University have also investigated the occurrence of colds among the students at their University (*Scientific Monthly*, March, 1931, Vol. XXXII, p. 235). They irradiated the students once weekly from October to the end of December, twice weekly from January to March and once weekly during April. Their conclusions were as follows :

"(1) Colds and their complications are our commonest disease-cause of student disability.

(2) Cold epidemics occur largely in the 17.9 to 27.5 per cent. of students definitely cold-susceptible and touch very little the normally resistant group.

(3) A combination of old and new methods applied to groups of cold-susceptible male students in our hands has resulted in a reduction of 42.5 to 58.26 per cent. in cold incidence.

(4) We have theoretical grounds for believing that attacking the colds in the cold-susceptible group will prove to be an effective way of modifying or averting the usual cold epidemics of our student body. We have as yet no positive evidence to present in confirmation of this belief."

Sir Leonard Hill and A. R. Laurie made some interesting observations on school children during the Autumn of 1929 and the Spring of 1930 in Derby.

They divided 250 children into four groups.

Group No. 1 were irradiated with a tungsten-cored carbon-arc lamp twice weekly at a distance of six feet.

The maximum dosage was 10 minutes to the front and back of the body.

Group No. 2 received a radiostol pellet daily.

Group No. 3 received a similar pellet which, however, contained no ergosterol, and they were also irradiated through a glass screen.

Group No. 4 were controls.

The results were as follows :

Liability to colds.	*Percentage Improvement.*
Group 1	30% ; also showed a gain in weight of 2.42 lbs.
Group 2	21% ; ,, ,, ,, ,, 2.17 lbs.
Group 3	15% ; ,, ,, ,, ,, 1.81 lbs.
Group 4	7% ; ,, ,, ,, ,, 1.91 lbs.

Correction of Nasal Abnormalities. Another important factor in prophylaxis is the removal or correction of certain abnormalities of the nasal cavities which obstruct the passage of air through them and prevent their ventilation. Mucus collects and

resistance of the patient to infection and there are several ways in which this can be done.

Exercise and fresh air. — Adequate exercise out of doors is very important, especially if associated with deep breathing. During the Great War, despite the hardships and exposure to wet and cold, there was a remarkable freedom from catarrhal conditions. Satisfactory ventilation of dwelling rooms, halls and public conveyances is essential, and windows in bedrooms should always be kept open.

Baths. Cold baths are very valuable for those who experience a healthy skin glow immediately afterwards; they are not suitable, however, for those who do not react in this way and who tend to become cold, cyanosed and shivery. Turkish and Russian baths are extremely useful as they promote profuse sweating and improve the condition of the skin. Air baths are also advantageous and have a valuable action in raising the body resistance. The writer remembers how pleasant he found the Luft Bad at Lahmann's Sanatorium, Dresden.

Clothing. Suitable clothing is another important factor. Overclothing should be carefully avoided and a mesh type of underclothing should be worn. The clothes, in fact, should be light, loose and porous.

Diet. A correct diet is of great importance and should contain adequate amounts of protective foodstuffs including vitamin A which, by helping to maintain the integrity of the epithelial lining of the air passages, has an anti-infective value. This vitamin is present in milk, butter and eggs and also in cod-liver and halibut-liver oils. Vegetables containing carotene and citrus fruits are also necessary.

Ultra-violet irradiation. The prophylactic value of general ultra-violet irradiation is now universally realized. Natural sun baths in the open air or exposure to a lamp emitting ultra-violet, visible and infra-red rays will produce the required effect. These different radiations have varying powers of penetration—the red visible rays reach the subcutaneous tissues but the short ultra-violet rays are absorbed by the stratum corneum of the epidermis. Ultra-violet rays increase the blood supply of the skin and thereby improve the nutrition of the epidermal and dermal cells—the skin becomes warmer and more active. It is able to adjust itself to greater variations in the temperature of the surrounding air, and hypersensitivity to chilling disappears. Erythema of the skin may occur and this is followed by pigmentation which increases the resistance of the skin to infecting agents.

Experimental work at Bournville. Much work on the prophylactic effect of ultra-violet irradiation has been done but probably the most recent is that by J. B. Sherman, the medical officer of Bournville Works; this work is described in the *British Medical Journal* of October 29, 1938. Four prophylactic methods were chosen.

(1) The administration of vitamins A and D. These were given in capsule form once daily throughout the winter.

(2) The use of dissolved vaccine, a mixed vaccine of certain organisms found in the nasal and pharyngeal cavities. 4 injections were given at 5-day intervals.

(3) Entoral vaccine, a mixed vaccine in a dried form designed for oral administration. This was given daily for 7 days, then once weekly throughout the winter.

(4) Ultra-violet irradiation with a long-flame carbon-arc lamp, at 3 feet distance, twice weekly, increasing to a maximum exposure of 14 minutes. Irradiation was carried out throughout the winter months.

A control group of 593 patients were given no prophylactic treatment.

Of 1,928 patients, 1,655 completed the course; omitting the controls (593), 1,062 patients were treated.

Sherman points out that two results could be expected, namely (a) a reduction in the number of colds contracted; and (b) a diminution in the severity of the colds.

PHYSIOTHERAPY IN THE COMMON COLD AND SINUSITIS

By W. KERR RUSSELL, M.D.

Physician-in-charge, Physiotherapy Department, National Temperance Hospital, and Light and Electrical Departments, Miller Hospital, Greenwich.

THE COMMON COLD

APART from all the discomfort and vexation which it causes, the common cold is also probably responsible for more economic loss than any other medical condition. The problem of the common cold is, therefore, worthy of careful study.

The nasal cavities are anatomically rather complicated; the turbinate bones greatly increase the surface area of mucous membrane lining the fossæ and slow the passage of air through the nose. Each nasal fossa is divided into respiratory and olfactory parts, the latter being uppermost. The mucous membrane of the nasal cavities contains many ciliated cells and also large numbers of goblet, or mucous cells. The ciliæ propel mucus and foreign bodies towards the pharnyx. Opening from the nose are passages into the antra and frontal, ethmoidal and sphenoidal sinuses—and also, through the nasal ducts, into the conjunctival sacs.

The functions of the respiratory portion of the nasal cavity are to warm, moisten and cleanse the air. The inspired air is heated to body temperature, moistened to saturation point, and cleansed of micro-organisms and other foreign bodies. The efficiency of this filtration mechanism can readily be seen after the inspiration of sooty, foggy air.

Symptoms

There are three stages in acute catarrhal rhinitis. The first is the congestive stage in which the nose feels uncomfortable, dry and stuffy, the mucous membrane becomes swollen, secretion is reduced and there is often a feeling of malaise, sometimes accompanied by a slight rise in temperature. This is followed by the early catarrhal stage in which the mucous membrane becomes more swollen, there is a copious watery discharge often associated with sneezing and lachrymation, and taste and smell are generally affected; the voice becomes husky and loses its natural resonance. Later, the swelling and infiltration of the mucous membrane subside and the discharge becomes viscid and muco-purulent and difficult to expel. If the condition is untreated it may persist for about a fortnight.

Ætiology and Complications

It is now thought that the principal cause of coryza is a filter-passing, ultramicroscopic virus. It has been found that sitting in a draught in an overheated and badly ventilated room predisposes to infection.

The chief complications which may occur are spread of the infection into the accessory nasal sinuses, the middle ear and also into the throat, larynx, trachea or bronchi.

Prophylactic Treatment

Treatment can be prophylactic or curative and at the present time the former is probably the more important. An endeavour must be made to raise the general

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Common Ailments and the General Practitioner

IN the daily working routine of the general practitioner particularly, a very considerable portion of time and effort is devoted to dealing with such common complaints as coryza, sinusitis and the many and protean forms of rheumatism. Unfortunately, these everyday disorders are by no means always amenable to everyday therapy and indeed often prove more resistant than some of the more serious disorders for which there is available a specific type of treatment.

As in so many other conditions, physiotherapy offers a measure of relief in many of these common disorders which the older materia medica cannot achieve. Some of these conditions are well described in the following pages, but others could be mentioned, as, for example, the value of ultra-violet light in that extremely common and equally intractable complaint, acne vulgaris.

In view of the ample assistance which physiotherapy can give to the general practitioner and the often impressive results which follow its use, it would seem that at least some of the less intricate forms of apparatus, such as the ultra-violet and infra-red lamps, would find a place in the equipment of every general practitioner who is really interested in his work and in securing optimum results for his patients. Yet this is still, we are afraid, far from being the case. From a more selfish viewpoint, moreover, the enhanced results obtained would add to his prestige and consequently—if we may be forgiven for touching on the material side, which after all is important, even if, like the ankles of Victorian ladies, it may be understood but rigidly excluded from polite conversation—to his income. For, the cost of installing and maintaining an ultra-violet or infra-red lamp, or even the more expensive short-wave unit, would undoubtedly repay itself many times, not only in money, but in the gratitude of patients.

Then why is the medical profession as a whole, of this country, so backward in taking advantage of the undoubted benefits of dispensing the more simple forms of physical medicine in the surgery? The answer is not that there is available a large body of highly-competent auxiliaries who can carry out this work for them, for they do not even utilize the services of this body to anything like the fullest advantage. Indeed a large proportion of the medical profession has, up till now, shown a strange reticence in seeking an adequate knowledge of the sound principles underlying physiotherapy and thus is not in a position even confidently to direct treatment.

This *Journal* has for many years been fighting to overcome this apathy and, though the fight has been at times discouraging, there are many signs of awakening interest in our profession which, exasperatingly conservative in some ways as it may be, is after all essentially sound and well-balanced. As we have consistently pointed out, the basic solution lies in education of the student and in adequate post-graduate teaching, so we repeat that, when our great teaching centres give adequate prominence to this important subject the new generation of doctors will grow up with a proper realization of its value.

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April
1939

adds that further study of this problem is indicated.

'Following each subject throughout the session discussions in which many authors take part are included and it is encouraging to note that some are becoming increasingly mindful of the "soil" in which the "seed" of this crippling disease continues to flourish.

There follows a reproduction of nine papers read at the open session for communications at Leamington Spa.

Part 2 opens with the presidential address by Lord Horder, and remarks on gout and rheumatism of metabolic origin by Prof. F. R. Fraser. Sir Walter Langdon Brown then continues on the subject of gout, and agrees that the exact relationship of uric acid to gout is not yet clearly defined, but stresses that it is those agents which produce an increased elimination of uric acid which are the most effective in this condition. Dr. Weil (Paris) continues by emphasising the prevalent co-existence of gout with many other rheumatic conditions—a fact which is becoming increasingly evident. Dr. Leslie Hill follows with a critical study of gout, aiming to establish definite criteria for diagnosis, and Drs. Gibson and Kersley discuss in detail the clinical and pathological findings in this condition. The radiographic aspect of the gouty foot is then considered by Drs. Weissenbach and Francon (France).

The second session consists of four short papers concerning gout, while the third session contains a collection of six miscellaneous papers on the following subjects: Spontaneous jaundice and rheumatoid arthritis (Hench); the circulation in relation to arthritis (Pemberton); the voluntary hospitals and rheumatism (Davidson); serological investigations in chronic rheumatism (Levinthal); notes on gold reactions (Copeman); and sciatica (Slot).

As in part 1, the discussions following each main subject are reproduced. Although some papers are not translated, all summaries are reproduced in English, French, and German. There are 7 plates and various diagrams and tables. The colour of the binding, paper, and print are not inspiring, but the book contains a vast amount of information and stimulus to research along certain definite lines. L. H. W.

RADCLIFFE INFIRMARY, OXFORD

Dr. W. D. Kiernander has been appointed whole-time Assistant Physician to the Department of Physical Medicine at the Radcliffe Infirmary, Oxford.

THE SOCIETY OF PHYSIOTHERAPISTS

Post-Graduate Lectures

The Executive Committee have arranged for a first lecture to be given to members on Tuesday, 18th April, at 7.30 p.m., at the Royal Institute of Hygiene and Public Health, 28, Portland Place, W.1. Dr. Francis Bach has kindly promised to lecture on that evening on the subject of Short-Wave Therapy. A further lecture will be given in April, and members will be advised of the date in due course. Members are asked to make a point of attending the lecture on 18th April, if it is possible for them to do so, and to advise the Hon. Secretary not later than 11th April if it is their intention to be present. After the lecture, members are invited to remain for social discourse and refreshment. This will enable the Committee to discuss with members the holding of further lectures in the autumn, as well as other matters of interest to their profession. A fee of 3s. is being made to cover part of the expenses; and members may bring a physiotherapist colleague if they wish to do so. The same fee will be made for non-member physiotherapists. Details have already been posted to members in London and the home counties, but particulars are published here in the hope that some members at a longer distance may be able to attend.

Annual Dinner

The Executive Committee at their meeting on the 15th instant discussed the question of holding an Annual Dinner, and it was agreed to do so. They, however, decided that the dinner should be additional to the afternoon At Home which has been held for the past three years, and which has been so much appreciated by members and their friends. Full details of the Dinner will be posted to members as soon as the date of the Annual Meeting has been fixed.

ERRATUM

The following correction to the paper by Dr. J. P. P. Stock on "Short-Wave Therapy in Asthma," published in the February issue of this *Journal* should be noted. On page 35, second paragraph from foot of page, line three, "water to 1 oz.," should read "water to 1 dr."

siasm, exploitation and lack of professional control, discredit is periodically visited upon it and its popularity wanes."

The author discusses the various factors predisposing to chronic infection, and he considers these to be primary foci of infection, inadequate immunological factors, allergy, mechanical defects interfering with function, trauma, functional disturbances of the autonomic nervous and endocrine systems, chronic vitamin deficiencies and neurogenic and psychogenic factors.

In chapter V the author discusses the functions of the liver, and he also devotes chapters to the different organisms involved in intestinal toxæmia. The anatomy and physiology of the colon are described in a chapter of 34 pages, and the author quotes Bastedo's definition of irrigation, namely, "that the term conveys the idea of washing, and, therefore, while the ordinary enema is given with the purpose of inducing defæcation, the irrigation is administered not to induce defæcation but to wash out the material situated above the defæcation area and to lavage the whole of the bowel as high as the water can be made to reach.

On page 107 the author says that the total amount of solution used at any one treatment should rarely exceed three gallons, but on page 110 he states, in a description of one method of irrigation, that from 6 to 8 gallons are required for each treatment.

Seven different methods of irrigation are referred to, namely, two methods used by Bastedo, the Dierker method, the Schellberg method, the Borosini method, the Vattenborg method using the Morse table, and the Honsaker method. From what the author says about the Borosini method, it seems doubtful whether he has had any personal experience in its use.

Fundamentally, methods of irrigation are either active or passive; they are active when bowel action is stimulated through the defæcation reflex, and passive when the bowel is emptied by suction.

The author is undoubtedly correct when he says that the chief cause of intestinal stasis is some disturbance in the autonomic nervous system frequently due to emotional strain and worry. Relief, in these cases, can only be achieved by dealing with the underlying emotional problem. In fact, the physician must be able to help his patient physically, mentally and spiritually As the author says, colonic irrigation alone rarely produces permanent results in this condition.

The author devotes two chapters to the problem of allergy and another to common causes of failure, and the final chapter is entitled "Prescriptions and Formulæ for Irrigating Solutions."

This is a very interesting book and well worth perusal. It enables the physician to appreciate the value of colonic irrigation when it is administered in a scientific way by those possessing medical qualifications. W. K. R.

Reports of Two Congresses on Rheumatism

Proceedings of the International Congress on Rheumatism and Hydrology (London and Oxford), and the Bath Bi-centenary Congress on Chronic Rheumatism (March 25th—April 2nd, 1938). 362 pp., illustrated. Price 12s. 6d London, 1938: Headley Bros.

Part 1 opens with the presidential address by Sir Farquhar Buzzard. In the first discussion, Dr. E. P. Poulton considers the factor of climate in the causation of disease. He is followed by Prof. Edstrom (Sweden), who deals with the climatic factors which he considers most important in influencing the human organism. Prof. De Rudder (Frankfurt), then describes those diseases which he considers are meteorotropic in ætiology and which he believes affect the organism through the vegetative nervous system.

The second discussion is on juvenile rheumatism. Dr. A. G Gibson on the pathology, emphasises that this disease almost invariably starts with an acute hæmolytic streptococcal infection, and stresses the factor of sensitization of the organism to the pathological processes. Prof. Klinge (Munster) adds that rheumatic fever is essentially a serious visceral disease. Dr. Leonard Findlay then deals with the clinical aspect, and states that, until the exact ætiology of rheumatic infection is established, none of the so-called rheumatic manifestations can be described as pathognomonic of this disease. Dr. Grenet (Paris) follows with an interesting study of symptoms, assessing their comparative significance. Dr. Sheldon continues with a discussion on general therapeutics. With regard to chemotherapy, his results with sulphanilamide were disappointing; if, however, the streptococcus is to be accepted as an ætiological factor in this disease, perhaps more attention to, and research with, this drug, should be encouraged, at the expense of contentment with the time-honoured salicylates. The social aspect is then discussed by Dr. Poynton, who

treatment was noted in 8 cases. In only 3 cases subjective improvement took place, and this ceased when treatment was stopped Only 5 patients showed a significant alteration in the curves of the sedimentation rate, and only 2 of these were improved subjectively and objectively. Five patients gained weight during treatment. The authors are of the opinion that massive doses of vitamin D are of little or no value in rheumatoid arthritis.

Treatment of Colon Infestation by Irrigation and Hot Instillations

Damaso de Rivas (*Arch. Phys. Ther*, 1938, xix, 756) found that a temperature of 45° to 47° C killed protozoan and metazoon parasites in from 5 to 10 minutes. He applied to the colon a 1-5000 hot copper sulphate solution through a rectal tube. The above temperature was maintained in the colon for the time mentioned. As a rule, 500 c c. of hot copper solution can be injected. Trichomoniasis usually required 5 to 10 treatments. For cases of oxyuriasis the best result was obtained by washing the entire colon with a hot solution of 1-500 copper sulphate two to three times a week for 10 to 15 minutes at a rectal temperature of 45° to 47° C, and for killing the *tricocephalus dispar* a solution of 1-5000 copper sulphate.

Electro-Fango Therapy

P Nicolesco and L. Chiosa (*Presse Méd.*, 1939, xlvii, 10) applied electricity to fango to increase the ionization of iodine; similarly to hydro-electric baths (intensity of current 40 to 80 milliamperes). The most striking results were obtained in ankylosis of joints, gouty deformities and contraction of the palmar aponeurosis

Short Waves

Delherm and Fischgold (*Jour. de Radiol. et d'électrol*, 1938, xxii, 594) do not consider short or ultra-short waves to be different from the forms of high frequency previously known. They believe that heat is the chief factor in their action and that heat and electrical effect are opposed to each other, heat diminishing the chronaxia and the electrical effect of diathermy or short waves increasing it. Short waves are of great benefit, particularly in those cases of arthritis which cannot be treated by diathermy owing to the difficulty in its application, as, for example, arthritis in the shoulder, knee, hip and vertebral column. Short waves are not superior to diathermy in cholecystitis, anal fissure, hæmorrhoids, or, particularly, in neuralgias, which are aggravated unless the dose is very weak Used intra-vaginally, they replace with advantage diathermy. Slight forms of hemiplegia and many cases of arteritis are ameliorated by short waves. The authors did not find that short waves of 20- or 7-metre length had a specific sterilizing action on the infected skin. X-rays seemed much more efficacious; using a 7-metre wave-length, they met with no success in pulmonary abscess

Fever Therapy by Pyrifer for Epidemic Infantile Paralysis

A. Alder (*Med. Klin.*, 1938, xxxiv, 1527) employed pyrifer for producing pyrexia in 25 cases of epidemic infantile paralysis. He began with 50 units and increased the dose every two days until he reached 500 units Nine cases gave good results; in 7 the effect was uncertain; and in 9 there was no benefit. Pyrifer and malarial treatment showed similar results: if one failed, the other did not succeed. No improvement occurred if the nervous supply to the muscles was quite cut off. The remedy was harmless and could be better controlled than malarial therapy. Treatment by pyrifer was advisable in every severe case of poliomyelitis.

Protection of the Skin Against Sunlight

Lachartre (*Ann. de l'Inst. d'Actinol*, 1938, xii, 107) recommends the following prescription for protecting the skin against sunlight: menthol salicylate, 4 gr.; zinc oxide and bismuth carbonate, of each 3 gr., oil of paraffin, 5 gr.; stearin, 3 gr.; glycerine, 9 gr.; water, 20 gr.; soda solution and gum tragacanth, q.s. The chief protection is afforded by the menthol salicylate.

Athermic Short-Wave Therapy

P Liebesny (*Arch. Phys. Ther*, 1938, xix, 736) found that short and ultra-short waves possess specific electrical effects. Short waves in athermic doses were found to have beneficial results in acute suppuration, such as facial boils, carbuncles, empyema of maxillary sinuses and also in some forms of chronic inflammation

Iontophoresis in Ophthalmology

G. Erlanger (*Arch. Phys Ther.*, 1939, xx, 16) used a combination of zinc and adrenaline (zinc sulphate, 1 :400 and 2 or 3 drops of adrenaline, 1 :1000, calcium chloride, 1 :300 and adrenaline or quinine hydrochloride, 1 :500) by iontophoresis in diseases of the cornea In acute infections of the cornea, zinc-adrenaline iontophoresis was first used for 2 or 3 treatments and afterwards calcium and adrenaline. In chronic cases, calcium-adrenaline iontophoresis was found more effective. In cases of herpetic origin, quinine iontophoresis may be applied.

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

U-V Light in Laparotomy

T. Marti (*Brunss Beitrage*, 1939, clxix, 84) has used U-V-R in abdominal operations for four years and corroborates their action in relieving pain and in exciting peristalsis. He found that in diffuse purulent peritonitis the Laparophos lamp had a distinctly favourable action, post-operative thrombosis, emboli and pulmonary complications being decreased. He considered it a valuable therapeutic measure.

Ultra-Violet and Visible Rays in Animal Septicæmia

A. J. Nedzel and L. Pincussen (*Arch. Phys. Ther.*, 1939, xx, 5) experimented on white mice infected with the *streptococcus hæmolyticus*. One group was not treated with any drug, the second was given sulphanilamide mixed with the food 3 days before injection of the streptococcus, and irradiation was employed in both groups 3 days prior to bacterial injections and was continued daily. The quartz-mercury and carbon-arc lamps were employed. The death rate decreased from 23 per cent. in non-irradiated animals to 8 per cent. when they were irradiated with the carbon-arc lamp, and to 15 per cent. in those irradiated with the quartz lamp. When sulphanilamide was given, the death rate was higher in the irradiated mice than in the controls, increasing from 8 to 15 per cent. with the carbon-arc and to 54 per cent. with the quartz lamp. When infected mice were treated with pitressin the death rate in the non-irradiated animals rose to 62 per cent., but was halved by irradiation, either by the mercury-quartz or the carbon-arc lamps.

Focal Infection, Rheumatism and Short-Wave Therapy

J. V. Ries (*Schweiz. med. Woch.*, 1938, lxviii, 989) warns strongly against exaggerating focal infection as a cause of rheumatism and especially against the removal of the teeth for quite slight rheumatic pains. Many people whose teeth are perfectly sound suffer from rheumatism, and others with many carious teeth never suffer from this disease. Collections of pus at the root of the teeth do not necessarily indicate removal of the teeth, as 10 to 15 short-wave treatments commonly suffice to cause absorption of the purulent foci.

Fever Therapy plus Local Heating in Gonorrhœa

E. H. Krusen, L. M. Randall and L. G. Stuhler (*Am. J. Syph Gonorrhœa and Venereal Dis.*, 1938, xxii, 185) report on 361 cases of gonorrhœa treated by fever therapy. The number of sessions was lessened by prolonging the duration of each session. The use of oxygen inhalations during treatment did not give satisfactory results with lower degrees of fever. High fever with oxygen inhalations, however, seemed to be slightly more effective than high fever alone. In women suffering from pelvic inflammatory disease, refractory to fever therapy, local pelvic heating with fever therapy gave good results. Single 10-hour sessions of fever therapy at 106.7° F. produced negative cultures in a high percentage of cases of gonorrhœa. A single long session of fever therapy combined with additional local heating was the most satisfactory method of treating gonorrhœal urethritis, cervicitis, pelvic inflammatory disease and some other complications of the infection.

Treatment of Syphilitic Diseases of the Central Nervous System

G. Voss (*Fortschr. d Therap.*, 1938, xiv, 625) discusses the treatment of diseases of the central nervous system by neosalvarsan, malaria therapy and inunction, and alludes to fever therapy induced by short waves applied to the head; he does not consider, however, that in Germany there are sufficient data on which to form an opinion of their value.

Treatment of Rheumatoid Arthritis with Vitamin D

N. Abrams and W. Bauer (*Jour. Am. Med. Assocn.*, 1938, cxi, 1632) administered large doses of vitamin D to eighteen patients suffering from rheumatoid arthritis in a stationary or slowly progressive state. Subjective improvement lasting during the whole period of

activity of the source of ultra-violet irradiation; these will be submitted to the International Congress on Light.

H. Biancâni describes the good results which he obtained by X-ray treatment and short waves in the cervico-brachial neuralgia.

X-ray therapy: paravertebral field from C5-D1, the direction of the X-rays is latero-internally; equal spark=25 centimeters; filter: 5 millimeters of aluminium—100 to 150r for each session; two sessions every week; total dose: 600 to 900r.

Two courses are recommended if the relief is not sufficient, with an interval of a fortnight.

Short waves: weak doses, a little electrode (its diameter should not exceed 6 cm.) is placed at the lateral side of the neck, opposite to the painful region; the other electrode is placed at the external side of the shoulder, the elbow, or the hand.

The duration of every session is 5 minutes.

If the neuralgia is so intense that the patient is unable to attend his doctor, the author advises beginning physical treatment by daily sessions of ultra-violet rays until sufficient relief occurs. This artificial sun-bath can be continued with profit during the sessions of X-rays or short waves.

PHYSICAL THERAPY NOTES FROM NEW YORK

By MADGE C. L. McGUINNESS, M.D.

Fuel Supply of the Sun

Professor Hans A. Bethe, of Cornell University, has been awarded the Morrison Prize of $500 by the New York Academy of Sciences for his solution of the mystery of the fuel supplying the sun with radiant energy upon which the earth depends.

He announces that the element carbon is responsible for the hot interior of the sun and other stars. According to this theory, the Normandie or the Queen Mary could be propelled across the ocean and back by the energy locked up in the nuclei of a cube of sugar. A collision of the various nuclei of the atoms liberates the energy required. Carbon and hydrogen are the chief actors in the drama of atom smashing. The hydrogen atom with its one proton nucleus smashes the carbon atom with its six protons to form the element nitrogen with its seven protons.

The nitrogen atom collides with the hydrogen and a new element results. When four hydrogen atoms enter what is left of the nucleus of the original carbon atom, split off and attract two electrons, helium is the result. The original carbon nucleus is revivified and the process starts all over again. The collision of the hydrogen and the carbon produces the exact amount of radiant energy known to be liberated by the sun at the rate of 10 million billion tons of coal per second.

On earth we burn the outside of the carbon, whilst the sun and stars burn the nucleus. On earth carbon burns in oxygen, in the sun and stars it burns in hydrogen. At the beginning of this century radioactivity was considered the source of stellar energy. Since the discovery of the bombardment and disintegration of nuclei, it has been assumed that such disintegrations supply the heat of our sun. It takes much higher temperatures, however, to set nuclei afire. Coal lights at a temperature of a few hundred degrees, atomic nuclei at about ten million degrees.

Everybody has agreed that the nuclear reaction could account for the heat and light of stars, but none knew which nuclei were the fuel in the stars until this present theory, which fits the known facts. The carbon nucleus is, therefore, most important of all the nuclei.

Dr. Bethe, formerly of the University of Munich, was associated with Lord Rutherford, Neils Bohr and Enrico Fermi, and his book on nuclear physics is the most authoritative now in existence.

This discovery of Bethe is in line with work done by Enrico Fermi, of the University of Rome, who recently received the Nobel Prize in physics for his discovery of new elementary radioactive substances when neutrons are irradiated. This in a measure ties with the awards made by the Royal Society, such as the Copley Medal awarded Neils Bohr for his work in physics.

Estimation of Cosmic Rays

Dr. E. C. Stevenson, Instructor of Physics, and Dr. Ivan A. Getting, Junior Fellow at Harvard University, have developed an instrument for counting particle radiation and particularly cosmic rays. It is known as a scaling circuit, and distinguishes random electrical impulses coming only fifty-thousandths of a second apart, and these counts can be made for months

(*Continued at foot of page* 87.)

THE WORLD'S NEWS AND VIEWS ON PHYSICAL MEDICINE

INTERNATIONAL REVIEW

PHYSICAL MEDICINE IN FRANCE

By Dr. J. SAIDMAN and Dr. J. ROSEN

At the last session of the " Société Française de Photobiologie et d'Héliotherapie," R. Krainik made an interesting communication concerning actinology in India. Scientific heliotherapy and polyradiotherapy has become more and more important in India since the creation of the Institute of Polioradiotherapy of Ranji Singhi, in the State of Yamnagar. A revolving solarium was constructed there from the plans of Dr. Saidman. There are ten cabinets which contain concentrators and filters; these filters allow passage of the invisible ultra-violet or infra-red rays, and some of the cabinets contain substances which absorb these rays and allow only visible sun-rays to pass. This solarium is completed by an artificial beach with mercury-vapour lamps and a polymetallic arc lamp. There is also an installation of short-wave and of X-ray units. The X-ray apparatus is in a room on the first floor, and the patient is put in an adjacent room. By this means it is easy to carry out teleradiotherapy if circumstances render this necessary. The medical director of the Institute is Dr. Mehta. More recently, another centre for scientific heliotherapy was opened at Draghandhra. Here there is only one revolving cabinet. This solarium is under the medical supervision of Dr. Malvanker.

Dr. Krainik concluded by quoting some typical cases cured by the treatment in the revolving solarium and by reporting the results of his researches concerning the sensitometric test on Hindoos, who are as sensitive to ultra-violet rays as European patients.

A. Dehnier studied the sexual behaviour of subjects who had sun irradiations, without medical control, on the beach of the Côté d'Azur. He investigated the question as to whether daily great sun irradiations had a peculiar effect on the performance of the genital function. The answer was negative.

R Tardy emphasizes the interest of spectrographic studies in Actinology and describes a simplified spectrograph, which serves to identify the number, the importance and the situation of absorption bands of ultra-violet rays in an organic liquid (serum for instance) The apparatus is composed of a vat of variable thickness, an optical spectrograph of quartz with mechanical and electrical arrangements which effect the removal of a photographic plate at a known velocity and the simultaneous variation of the traversed liquid, and the spectrogrameter which facilitates the reading and interpretation of the absorption figures.

Bérard discusses lipidol injections into the fistulæ occurring in tuberculous osteoarthritis. The radiograph shows bone lesions which are distant from the skin fistulæ. The length of the fistular passage explains the difficulty of obtaining their cicatrization.

Saidman, under the title, " Demands for a definition of Finsen's unit," repeats the reports he made at the Congresses of Paris and Copenhagen. Although the biological proceedings are very complicated, the erythemal effect is the best criterion for these measures That is why it seems logical to choose for unity the erythemal effect of the most active radiation (2967 A.U.) and to give to the other radiations a coefficiency which varies from 1 to 100.

At the end of the session a commission was formed which was composed of four members, Professor Jausion. Professor Strohl, Dr. Saidman and Dr. Latarjet. This commission proposed the adoption of definitions of dosage and

incisions are not too deep; moreover, proper control of the intensity and quality of current employed is essential to reap all the benefits offered by this modern form of surgery.

KINDS OF CURRENT

An important requirement for cutting with high-frequency electric currents is that the current value shall not be too greatly damped, i.e., the periods between electric impulses shall not be long compared with the duration of the impulse or train of impulses. The current value (milliamperes) should be just sufficient to maintain the cutting arc in the high resistance as well as in the low resistance parts, but not to have deep coagulating effects.

Coagulating current is generally of a higher value than cutting current since it has to destroy unhealthy tissue, burning it out and forming a granular residue.

Dehydrating current, being required to direct a shower of sparks upon a blemish may be of higher voltage than cutting or coagulating currents and the use of a damped-wave form does not prevent satisfactory results being obtained.

Spark-gap type and valve-type apparatus are both used in surgical diathermy. The remarks above in reference to damped waves of current only apply to spark-gap apparatus, since valve generators produce continuous waves of uniform amplitude. On the score of availability of ample power, quiet running and constructional simplicity, valve generators have advantages over spark-gap apparatus, but some operators nevertheless prefer spark-gap type machines for certain classes of work.

The importance of using the appropriate current for the various forms of surgical work should be emphasized.

In general, the strength of current is varied by coupling and tuning of the high-frequency transformer. Voltage is controlled by variation of supply tappings or by adjusting primary resistance in the supply transformer.

When specifying or purchasing apparatus, care should be exercised to see that proper provisions are included for control of currents for the various treatments envisaged from the apparatus.

**B.J.P.M.*, 1938, vol. 1, New series, page 425, December.

* * *

The author wishes to state that a slip occurred in drawing Fig. 137 of last month's article. The connection between the main transformer secondary and the valve filament circuit was omitted and the symbol for a condenser incorrectly appears in the ammeter lead. The figure will be amended when the articles are published in book form.

PHYSIOTHERAPY IN FURUNCULOSIS—*continued from p. 74*

autovaccination, seems to apply equally to furunculosis. We also consider that ultra-violet light, provided that a suitable type and a correct dosage is employed, constitutes the best general treatment for furunculosis.

Resume

Physical agents must be employed systematically in recurring or severe furunculosis.

A furuncle or severe carbuncle should be treated immediately by X-rays or short-wave therapy.

Recurring furuncles should be treated by general ultra-violet irradiation.

These techniques do not prevent the use of biological or medicinal agents when the physician deems them necessary.

In this application of high-frequency electricity, the currents are employed for the dehydration, coagulation and cutting of tissue. All these effects are produced by a concentration of the current locally at the required point by the application of an electrode of very small area. This small-ended electrode is called the active electrode and the other is called the indifferent electrode. The indifferent electrode is of large area and may be placed at any convenient point. For cutting upon the chest, for example, the indifferent electrode may be situated in the lumbar region. The active electrode has a blade, ring or ball-end depending upon the type of work to be done, while the indifferent electrode may be of metal foil similar to that employed for medical electrodes.

A very wide range of active electrodes is available with modern surgical diathermy apparatus. These include rings, discs, balls and blades, all designed for specific operations. These metal electrodes are mounted on insulating handles and have neat fittings for effecting connection with the high-frequency generator. The indifferent electrode is appropriately placed as mentioned earlier and having a pad of lint or flannel soaked in a saline (10 per cent.) or sodium bicarbonate solution between it and the skin.

Dehydration. A technique employed for dehydration, or as it is also called, electro-desiccation, is to allow a shower of sparks from an active electrode to fall upon the abnormal tissue by bringing the electrode very near to, but not touching, the affected part. The sparks dry the surface at which they are directed and the drying action deepens as the treatment proceeds.

Coagulation. For coagulation a familiar instrument to use is a ball, or button-ended, active electrode which is brought into contact with the diseased tissue and the heat of the concentrated current burns it away. Two active electrodes are sometimes used in a bi-polar application of the current to the diseased part.

In another technique a blade or needle-type active electrode is employed, incisions being made round the diseased tissue, the instrument remaining in one position long enough to produce local coagulation before being withdrawn and inserted in an adjacent position. A circle of coagulated tissue is thus made which isolates the diseased region from healthy tissue, the diseased portion being capable of removal by cutting current afterwards.

Cutting. When used for cutting, a wire (needle or ring) or blade-type active electrode is used. This active instrument is brought to the tissue and, just before contact with it, a spark spans the gap and the spark is followed by an arc which persists as the electrode is introduced into the tissue. The arc cuts the tissue and in addition coagulates the surfaces of the incision preventing the escape of blood from the small vessels. Larger blood vessels cut in this way can be sealed by nipping the divided end between forceps* and touching the forceps with the active electrode, turning them into a coagulating electrode.

The amount of coagulation that occurs on the walls of the cut depends upon the cutting current, the speed of movement of the electrode and the nature of the tissues. Coagulation to a depth of about a millimetre is normal. Operating conditions must, of course, be controlled so as to prevent coagulation so deep that subsequent healing is delayed.

An advantage of the coagulation is the reduction of hæmorrhage and the consequent reduction of risk from the flow of infected fluids in the region of the wound. It is claimed also that electro-surgery is quicker and less painful than ordinary surgery and that subsequent healing is rapid and good. The comparative ease with which electro-cutting is achieved means that great delicacy of touch is required to ensure that

*E. P. Cumberbatch. *Electrical Review,* 1931, vol. 109, p. 799.

such as touching their thumb with their forefinger (which spastics cannot do at first), but they cannot carry out the corresponding action of holding a pen steadily.

Lower Motor-Neuron Lesions.—The nerve diseases which benefit most from physiotherapy are those of the lower motor-neuron type (flaccid paralysis), whether the lesion is in the peripheral nerve, as in diphtheritic paralysis and war-injuries; in the spinal cord motor-cells, as in poliomyelitis; or in the nerve plexuses, as in some " birth-palsies " of, for example, the Erb type.

Those in which the lesion is outside the spinal canal differ from poliomyelitis and disseminated sclerosis in that there are sensory loss and severe trophic changes as well as the actual paralysis. In some cases of poliomyelitis, the poor circulation, arthritis and extreme atrophy of the whole limb suggest that trophic as well as motor fibres are involved.

These circulatory disturbances demand treatment by means of heat, douches and massage, care being taken to avoid burns, etc.

The actual paralysis may be complete in a limb or muscle, as a result of general death of nerve cells or nerve fibres; in such cases no treatment can cure; as a rule, however, some power remains and then weak muscles can be coaxed into increased activity and development, until useful function is restored to the part, though it may remain extremely wasted. One must remember that few individuals make full use of the reserve capacity of their muscles to hypertrophy, and the surviving muscle fibres still keep this capacity after a nerve illness. The ordinary individual does not have arms like a prize-fighter; why should not the patient, recovered from poliomyelitis, have arms as good as a clerk, even if he has lost fifty per cent. of his upper limb musculature.

As already remarked, re-education in a deep pool, and, later the use of pulleys and graded weights will do wonders in such cases, provided the enthusiasm of the patient is secured throughout.

It is generally supposed that neuritis of the arms and sciatica are the commonest forms of lower motor-neuron disease; but, although pain in the distribution of these nerves is common in damp countries and with certain occupations, the primary disease in most of the cases is an arthritis of the spinal joints in the neighbourhood of the corresponding nerve roots, or a fibrositis of the muscles, between which the nerve trunks run. Treatment accordingly should be directed to the arthritis, and care taken not to irritate the peripheral nerves further by heavy massage to their trunks and nerve endings, as is quite often done. Heat should be applied to the affected joints in the neck and lumbar spine, not to the hand or foot, though the patient refers the pain to the latter.

Other Conditions.—There are one or two rarer forms of " palsy," for which physiotherapy can do something, though it cannot effect a dramatic cure. These are the inco-ordination of movement due to chorea (St. Vitus' dance), whether of the rheumatic or congenital type, and the athetotic type of inco-ordination, in which frequent involuntary movements interrupt the patient's actions, though he can control the limb between such jerks, which rather resemble those of tetanus, or strychnine poisoning. These cases benefit from careful re-education of movement, especially occupational therapy, e.g., coarse weaving, etc.

SUMMARY

To sum up, the role of physiotherapy in the treatment of nerve diseases is as follows:

(1) To improve the circulation by heat, douches and massage.

(2) To render and maintain joints over which the patient has lost control, in a mobile condition, by putting the joint through the full normal range of movements at regular intervals, preferably once a day.

(3) To restore the patient's confidence in himself by the exercise of a cheering

Contd. on p. 115

PHYSIOTHERAPY IN MINOR INJURIES'

By W. E. TUCKER, B.Ch., F.R.C.S.
Orthopædic Surgeon, London Homœopathic Hospital.

THE treatment of minor injuries to the soft tissues has passed through many phases, and there is no question that the present-day methods of support and active use are far in advance of the older ones based on rest. There are many subtle points in the modern methods that must be thoroughly understood if satisfactory results are to be obtained in the shortest possible time.

Injuries to the soft tissues may be direct, in which case contusion and bruising takes place, or indirect, in which case structures are stretched and torn. In both cases the result is an effusion in and around the injured tissues. Such an effusion consists partly of extravasated blood and partly of lymph and serum, and it results in the formation of an area of local tension which is extremely painful.

EFFECTS OF INJURY

The effects of this effusion on the surrounding structures fall into three groups:

On the muscles.—At first, as a result of irritation, the muscles go into spasm. Often it is this spasm which holds the patient rigid and gives rise to pain on the slightest movement. Later, as a result of interference with the venous and lymphatic circulations, and also of damage to nerve fibres, there are loss of tone and wasting. This loss of tone may appear within a few hours of the injury, and is very characteristic. In certain cases, usually where there is damage to synovial membrane, the loss of muscle tone appears to be out of proportion to the amount of tissue damage. For example, in strains of the internal lateral ligament of the knee-joint, wasting of the quadriceps may be apparent in twelve hours and, if untreated, may become very severe in a few days' time. There would appear to be two main causes of loss of tone; firstly, the accumulation of waste products in the muscle as a result of interference with the circulation, and secondly, a reflex inhibition of tone producing nerve impulses. Either of these may predominate in a given case.

On the circulation.—The venous and lymphatic circulations are disturbed and, although the part is engorged with arterial blood, this cannot escape because of the damage to the returning circulation. There is stasis and consequent accumulation of toxic waste products in the tissues.

On the nerves.—The nerves may be damaged by a direct blow or stretch, and fibres and nerve endings may be poisoned by toxic elements in the effusion.

At a later stage much of the effusion may be absorbed into the circulation, but some may become organised into fibrous tissue which forms adhesions and fibrositic deposits between adjacent structures and in association with the sheaths of muscles and tendons.

METHODS OF TREATING MINOR INJURIES

Our objects in treatment are to produce: (1) firm healing; (2) restoration of all movements; (3) re-establishment of muscle tone; (4) absorption of all exudate; and (5) freedom from adhesions.

Many cases of injury in which strapping has been carried out followed by active movements, recover completely in a reasonably quick time. The danger, though, is

that traumatic effusion may spread and tender thickening or adhesions form in places some distance away from the original injury; for example, adhesions and thickening may occur over the sacrum following an injury to the erector spinæ muscle in the upper lumbar region.

To attain the above objects we have the following means at our disposal: (1) first aid (strapping, etc.); (2) heat; (3) massage; (4) diathermy; (5) galvanism, ionization; (6) active and manipulative movements; (7) graduated faradic muscular contractions; (8) injections of various kinds; (9) aspiration of bruises and synovial effusion.

First Aid.—To obtain the full advantage of strapping and supporting bandages these must be applied early. Firm bandages prevent the traumatic effusion becoming excessive, and at the same time aid the weakened muscles in supporting the damaged structures. The general principle should be to restrict those movements which cause pain and to encourage active use.

Heat.—Infra-red or radiant heat can be applied for 15 to 20 minutes before massage to help muscular relaxation and especially to bring about vaso-dilatation and improved circulation. It can be given simultaneously with massage and graduated muscular contractions.

Massage.—In giving massage one should consider the time which has elapsed since the injury, and the type of patient. In the early stages effleurage aids relaxation of spasm and absorption of effusion. Any form of deep massage at this stage will only produce pain and increased spasm. Later on, when tender thickenings have formed, deep massage may be necessary. Robust and healthy patients need heavy massage, especially if there is chronic fibrositic thickening. Similar treatment for the same condition in a frail and toxic type of patient may bring disastrous results in the form of severe reactions. Patients comment freely on the abilities of their masseuses. One is too vigorous and makes it worse, another is too gentle and accomplishes nothing.

Diathermy.—Short-wave diathermy is becoming more widely employed. It conveys a more general heating effect deeper into the tissues, and in the early stages promotes absorption. Later, it is of value in helping to free stiffened painful joints.

Galvanism and Ionization.—In the treatment of recent injuries, it has been found from personal experience that the use of small currents from three to five milliamps, after the teaching of Dr. Heald, gives good results. If histamine ionization is given, the use of small currents is essential. Treatment is continued until the first sign of reaction, when the current is switched off. If the current is small the conveyance of the drug into the body ceases at once, and severe reactions are avoided.

Graduated Faradic Contractions.—This method of treatment is frequently badly given, and a most powerful and useful method of treating both recent and chronic injuries is wasted. The important points are that the contractions must not cause pain or muscle fatigue, and that at least two thousand contractions should be given over about 40 minutes. The masseur must give the treatment himself; no mechanical device can take his place.

Active and Manipulative Movements.—It is imperative to realize that every joint has a very slight range of involuntary movements as well as the voluntary ones and, until all movements are full and painless, the object of treatment has not been attained. To ensure that active movements are properly carried out, the patient must be given detailed instructions, preferably in the form of simple exercises. For example, in the case of injury to the knee or thigh the patient might be instructed to sit on the edge of a table with the legs hanging down. He then fully extends each knee alternately, say ten times, and repeats the exercise three times a day. Failing adequate instructions it will be found that patients tend to go to extremes, either resting the part too much, or exercising too vigorously and aggravating the condition by fatigue and spasm. Manipulative movements, in conjunction with heat, massage and contractions should be carried out daily. Both voluntary and involuntary movements must be obtained.

Gentle movements of this kind will be found of the greatest value and seldom fail to increase the range of movement. Muscle spasm may sometimes be an obstacle but can usually be relieved by spraying or injection, as described in the next paragraph. Forcible manipulations are indicated in the later stages when movement in one or more directions is limited by firm adhesions. Each manipulation should have the object of breaking down a specific adhesion, after careful comparison with the movements of the normal joint. If one adhesion is broken at a sitting the reaction will be slight and a general anæsthetic will rarely be necessary, except in the case of fibrous adhesions of many months' standing. Never manipulate forcibly in the presence of much chronic thickening; the resulting reaction may be very severe and, by the time it has settled down, further adhesions will have formed.

Injections of Local Anæsthetic.—I was pleased to see that Mr. Sayle Creer, in a recent number of this *Journal**, advocated local injection or the use of an ethyl chloride spray. Either of these methods appears to prevent excessive swelling and to reduce muscle spasm, and is therefore useful both in the early stages and later when the chronic stage is reached.

Aspiration.—Synovial effusions and large hæmatomata may both be aspirated. Small synovial effusions may be left, however, as they almost invariably are absorbed rapidly during treatment. An effusion of blood in a joint should always be aspirated, as it is frequently followed by firm adhesions.

CLASSIFICATION AND SCHEMES OF TREATMENT OF MINOR INJURIES

For the present purpose, injuries may be grouped as follows:

(1) Direct injury to the soft tissues in which there is bruising or tearing of the substance of the muscles.

(2) Indirect injuries; (*a*) uncomplicated strains of tendons and ligaments; and (*b*) similar strains associated with damage to synovial membrane.

Treatment of these groups may be summarized:—

Muscle Bruising.—(1) Supporting bandage; (2) ethyl chloride spray; (3) aspiration of hæmatoma; (4) heat and effleurage, later deep massage; (5) anodal galvanism (6) short-wave diathermy; (7) graduated muscular contractions; (8) home treatment, i.e., exercises, unskilled massage, hot and cold contrast baths.

Simple Strains.—(1) Support, strapping or, in severe cases, plaster of Paris; (2) anodal galvanism; (3) graduated muscular contractions; (4) manipulative and active movements; (5) home treatment.

Strains with synovial tear.—(1) Support; (2) heat, massage and galvanism; (3) graduated muscular contractions; (4) aspiration; (5) manipulative movements; (6) exercises.

"RHEUMATIC" STRAINS

Under this heading can be placed a group of conditions which can be regarded as minor injuries occurring as complications in cases of fibrositis and muscular rheumatism. Conversely in patients of a rheumatic type with septic foci of various kinds, a rheumatic element may become superimposed on what was originally a simple strain.

Typical examples of this type of case are strains of the neck muscles, and lower back strains simulating lumbago. Often in these cases the patient will say that he has experienced discomfort for a day or two before the condition suddenly becomes acute. Careful inquiry often elicits a history of minor trauma. My contention is that there

*CREER, W. SAYLE. "Physiotherapy in Orthopædics." *Brit. Jour. Phys. Med.*, New Series, 1939, Vol. 2, p. 50, February.

is in existence a mild fibrositic state in the muscles, an area of subacute inflammation. A sudden minor strain occurs and one of the following things happens:—

(1) The muscle passes into a condition of spasm which is maintained by the irritation of the fibrositic infiltration. This results in the part being held in an abnormal position, with a great deal of pain, e.g., acute torticollis and sciatic scoliosis.

(2) The unhealthy muscle, in a state of spasm, tears. The torn fibres form a suitable medium which becomes involved in an extension of the fibrositic process.

(3) In other cases the diseased muscle responds poorly to sudden demands made on it, and strain is taken on the underlying ligaments and joints. In extreme cases subluxation may take place. This is a possible mechanism in many cases of backache.

TREATMENT

Treatment in these cases follows the general principles laid down above, but must be extremely gentle. There is often an associated neuritis and over-energetic treatment may stir this up causing great pain. The wisest course is probably to rely mainly on heat and sedatives. An attempt may be made to correct deformity due to spasm by gentle manipulation, the parts being held in the corrected position by supporting bandages and felt pads. A crêpe bandage over a shaped felt collar, for example, will bring about a surprising degree of relief in a patient suffering from a "stiff neck." In this connection we might recollect that our grandmothers advocated winding a woollen sock round the neck. Treatment on these lines will often result in improvement in two or three days.

Cases which fail to respond are often associated with a toxic focus which must be eradicated. The question of forcible manipulation has to be considered, but in my opinion this procedure is inadvisable. Those cases which would not recover with forcible manipulation will recover with gentler measures within a week, and, if there should be an underlying toxic element, manipulation may bring about exceedingly severe reactions.

Rheumatic teno-synovitis, such as occurs in the tendons of the extensor ossis metacarpi pollicis and the tendo Achilles, come under this category. If recent, rest, antiphlogistine, or counter-irritants such as Scott's dressing may cure these cases quickly, but when the condition has become chronic they present the greatest difficulty.

Many practitioners consider that operative measures are essential, especially in the sclerosing vaginitis of the thumb extensors. This is not altogether true, because in some cases, if the thickening is not excessive, immobilization in plaster for two to three weeks, followed by a fortnight's treatment consisting of histamine ionization, gentle contractions, and massage, will bring about remarkable results. If physiotherapeutic measures are given in the early stages, or before a period of rest, disappointment will be experienced.

CONCLUSION

In conclusion it may be said that adequate use of physiotherapy with a proper understanding of the object of each form of treatment will result in rapid improvement in most cases of minor injury with a minimum of after-effects. Merely strapping a strained joint and resting it for three weeks while the patient works out his own salvation is not enough, when proper treatment will halve the period of disability.

PHYSIOTHERAPY AT THE NEW WESTMINSTER HOSPITAL

On Thursday, 20th April, the King, accompanied by the Queen, will open the new Westminster Hospital in the presence of 2,500 guests. The Hospital can best be described as the newest and most modern of hospitals, as everything possible has been done to incorporate in it the latest and most up-to-date ideas and methods. With this end in view visits have been made to modern hospitals, not only in this country but abroad. Of special interest to readers of this *Journal* will be the new Physiotherapy Department of the Hospital, and an article describing this, written by Dr. William Beaumont, Physician-in-charge of that Department, will be published in our May issue.

PHYSIOTHERAPY IN FIBROSITIS AND THE MYALGIAS

By FRANCIS BACH, M.A., M.D. (Oxford)

Assistant Medical Officer in Charge of the Electrotherapeutic Department, St. Thomas's Hospital; Physician to St. John Clinic and Institute of Physical Medicine and to the Rheumatic Unit of St. Stephen's Hospital (L.C.C.).

ALTHOUGH fibrositis and muscular rheumatism are terms that are in common use, little is known as to their exact nature. Reference to them is continually being made in clinical work, as though they were definite clinical and pathological entities. Stockman, some years ago, made careful histological studies of these conditions, but little effort appears to have been made to repeat, confirm, or extend his observations.

There is little doubt, however, that many painful conditions which were formerly thought to be primarily muscular in origin are to-day recognized as being secondary to disturbances of the skin, the joints and the bones. Even to-day, however, a diagnosis of muscular rheumatism, myalgia or fibrositis is too often made. The more carefully the differential clinical diagnosis is made, and the more often radiological and laboratory examination is employed in routine work, the less often will muscular rheumatism be made to account for the symptoms of which the patient complains.

PATHOLOGY

Stockman, on histological examination of rheumatically-diseased muscles, found local exudation of serum, proliferative changes of the tissues with fibroblasts, new capillary formation and sero-fibrinous œdema of the ground substance. At this stage the tissue swelling remained localized, and disappeared spontaneously, or could be comparatively easily dispersed by massage. If the tissue changes persisted the new tissue gradually became denser, the sero-fibrinous matrix gave place to more perfectly-formed and fairly definite fibrous tissue elements, the small blood vessels became much more numerous, their coats gradually thickened and the minute nerve filaments showed increase of their fibrous sheaths. Localized nodules or nodular thickening of localized areas of fibrous tissue occurred in the fascial sheath of the muscle, and was usually embedded in the muscle substance. Buckley, in a recent publication, has described fibrositis as a non-suppurative inflammatory process affecting the white fibrous tissue. It may be relatively acute or chronic, limited to small areas, single or multiple, or may affect a considerable area of the body. The wide distribution of fibrous tissue in the body leads to a great variety of symptoms, depending on the tissues affected. The principal structures liable to be involved are superficial and deep fasciæ, aponeuroses, ligaments and capsules of joints, tendons, tendon-sheaths, periosteum and nerve-sheaths.

AETIOLOGY

Focal Sepsis

Fibrositis may be the result of one or several ætiological factors.

An important factor is focal sepsis which may be in the vicinity of, or at a distance from, the rheumatic lesion. For instance, in infections such as tonsillitis or influenza, muscle pains may occur and be a dominant symptom, and the chief objective signs may be associated pain and tenderness of the affected muscles. The rheumatic pains, the stiffness and the tenderness of the muscles and joints which characterize the symptomatology of rheumatic fever are due in part to reflex muscle spasm, but more particularly

to inflammatory changes localized in the muscles, tendons and synovial membrane. The nasal sinuses, the teeth, the tonsils, the digestive, biliary and uro-genital tracts are all held to be distant sources of focal sepsis, from which organisms, such as the various strains of streptococci or *B. coli*, usually considered to be of attenuated virulence, are held to initiate the inflammatory changes in the interstitial fibrous tissue of the muscles. Metabolic disturbances, such as gout, diabetes, certain forms of raised blood-pressure and menopausal obesity form another group. The underlying causes are constitutional and endocrine disturbances. The production of muscular rheumatism appears to be essentially dependent on disturbance of the normal removal of chemical products of muscular activity.

Fatigue

Both the general physical tiredness of old age and the fatigue associated with psychological factors in the young, are yet other causes. In untrained persons, excessive or unusual exercise may cause local or general fibrositis, the symptoms being probably due to inadequate circulation in the muscles and retention of products of metabolism. The aching and stiffness of which old people complain are in part the outcome of the tendency towards increased fibrous tissue formation that is associated with old age.

Generalized rheumatic pains and a feeling of fatigue like many other compensatory symptoms, are frequently a disguise for more or less serious emotional maladjustment. Tiredness may be general or may apply to some part of the body, as the back or limbs, or to that part of the body primarily involved in the performance of the individual's work. Extraneous physical factors, such as chilling, may be a common cause of muscular rheumatism and frequently produce the clinical picture of stiff-neck and lumbago. Low temperature, air in movement, moisture, and immobility of the affected part appear to constitute a combination of factors which may produce this clinical condition. It is probable that reflex contracture of the skin vessels and contraction of the blood vessels in the underlying voluntary muscles occur. Small or large areas of muscle have their capillary circulation disturbed, leading to autonomous capillary contraction with spasm and capillary congestion. Congestive hyperæmia and serous transudation follow.

Trauma

Gross trauma may be the cause of muscular rheumatism. Local injuries, causing bruising with subsequent effusion of blood and lymph, may provoke fibrous areas. Sprains of muscles or ligaments which are richly supplied with nerve endings may produce a similar picture. Repeated small traumata, due to repeated slight strains, which commonly occur in certain occupations may produce various forms of muscular rheumatism. Shoulder strains leading to sub-acromial bursitis, tennis elbow, and Dupuytren's contracture, due to chronic irritation of the palmar fascia, are examples of these conditions.

Other Factors

One group of fibrositis is associated essentially with toxins of bacteriological origin, another with toxins of metabolic origin and another with wear and tear or trauma associated with defective repair of occupational strain or advancing years.

In brief, little is known of the pathology of fibrositis, although a fair amount has been learnt of its ætiology. But it should be seen from the foregoing description that a variety of different conditions must be recognized and should be treated as important factors in the probable causation of muscular rheumatism.

CLINICAL PICTURE

Pain and stiffness are the main symptoms, and they vary in degree with the part affected. Tension is an important cause of pain, and is often due to the swelling of tissues where they are tightly bound down, as in muscles lying between aponeuroses and bones, or to strain upon inflamed ligaments, or compression of nerves or nerve endings by the swollen tissues. Palpation of the affected part may reveal obvious muscle spasm, as over the trapezius or gluteus maximus muscle in acute fibrositis of the shoulder or buttock respectively. In the subacute or chronic stage, local induration or nodular areas may, on palpation, be detected lying superficially or deeply embedded in or between the muscles. In the chronic stages stiffness, which may be general or localized, may cause referred pain and partial or complete limitation of movement of the affected part.

Panniculitis

Panniculitis is a peculiar form of fibrositis in which the subcutaneous tissues of the panniculus adiposus may be affected in a diffuse form involving large or small isolated areas. Areolar connective tissue is hypertrophied. There is marked diminution of the elasticity of the tissues. Clinically the affected areas usually are found situated over the 7th cervical vertebra and extend to the trapezius and supraspinatus muscles in the supraclavicular region, and commonly on the inner side of the knee-joints, the upper end of the tibiæ, the outer sides of the thighs, and on each side of the ankle and dorsum of the foot.

Bursitis

Bursitis occurs at the insertion of tendons in the vicinity of joints with which they communicate. Bursæ may vary in character from little more than exaggeration of the spaces of aerolar tissue to definite sacs lined with synovial membrane. Acute bursitis may be accompanied by effusion and distention of the sac, giving rise to pain and muscle spasm, and later to adhesions. Supra-acromial bursitis of the shoulder area is common and peri-articular fibrositis may be a common complication. Peri-articular fibrositis affecting the joint capsule, beginning outside the joint, may in the later stages affect the synovial membrane and may form adhesions to the bursa or within the bursa itself, and produce a painful joint with marked limitation of movement. Fibrositis of an aponeurosis or nerve sheath is common. Occipital fibrositis may cause severe and chronic headache. "Neuritis" of the 7th cranial nerve due to fibrositis of the nerve sheath may give rise to a Bell's palsy. Stiff-neck, fibrositis of the shoulder, of the pectoral or intercostal muscles, and fibrositis of the back, producing acute and chronic lumbago, are all forms of muscular rheumatism.

TREATMENT

It will be realized from the foregoing description that, in certain circumstances where the infective or metabolic factor is a dominant one, general treatment, both by physical measures and by the use of drugs is of paramount importance. In other forms, in which local strain or trauma is the dominant factor, local treatment by physical measures may be of definite value in the relief of the condition. In every instance careful differential diagnosis must be made. When indicated, general treatment in the form of rest, dietetic restrictions, drugs such as aspirin or veganin to relieve pain, and iodine and colchicum to combat underlying ætiological factors, must be prescribed. If evidence of glandular disturbance is present, œstrin or thyroid may be necessary. Occasionally removal of septic foci, such as septic teeth, or the treatment by physical or other measures of infected sinuses, prostate or gall-bladder may be indicated.

The physical measures that may be employed depend essentially on what the physician considers to be the essential factors requiring treatment. Frequently rest of the affected part with strapping, plaster, slings or splinting is the first indication in treatment. In a sub-acromial bursitis an aeroplane splint may be indicated. In

intercostal fibrositis or sacro-iliac strain, strapping may relieve the symptoms. In tennis elbow or in painful flat foot, strapping or a light plaster splint may be of value. To relieve pain and reduce muscle spasm the local application of heat in the form of plasters, poultices, hot compresses and electric pads are all indicated. Wax baths and radiant-heat lamps are of special value.

In conditions such as acute lumbago, in which muscle strain, general fatigue or gout are important ætiological factors, hot brine baths, mustard baths and foam baths may be of immediate value. A course of brine baths may be of definite use in the treatment of the muscular manifestations of gouty rheumatism. The diffuse rheumatic pains associated with obesity and raised blood pressure may be relieved or modified by a course of foam baths. This is due probably to an improvement of the peripheral circulation, dilatation of capillaries and arterioles, and a diminution in venous pressure.

Vichy douching associated with general massage may relieve the rheumatic symptoms of a generalized fibrositis. Careful under-water massage of areas of local muscle-spasm or defined nodular areas should relieve diffuse rheumatic pains referred from such localized areas. A course of treatment with an Aix douche may relieve conditions such as fibrositis of the shoulder or gluteal area.

Ionization with salicylates, iodine or histamine may be of definite value in the treatment of an acutely painful fibrous area. Histamine ionization applied locally may relieve the pain of " villous arthritis " or panniculitis of the knees or shoulders. Anodal galvanism, with a pad on the cervico-dorsal area, and hand baths may relieve an " acute brachial neuritis."

Diathermy or short waves may be indicated in the treatment of an active focus of infection such as an infected sinus or prostate. They may also be of value in relieving painful spasm of muscles of the back and shoulder or elsewhere in the body. In acute or subacute lumbago, short-wave therapy, associated with gentle faradic stimulation of the affected muscles, may hasten recovery and relieve the essential symptoms. Graduated muscular contractions with a Bristow or Smart Coil may be carried out in order to free adhesions, to increase local blood and lymph supply and to hasten the absorption of inflammatory thickening. General ultra-violet irradiation employing the tungsten, carbon-arc, or mercury-vapour lamp may relieve the fatigue or generalized rheumatic pains associated with juvenile rheumatism, subacute rheumatism of early adult life, the generalized rheumatic pains following influenza, or the aches and pains associated with advancing years.

Manipulation plays an important part in the treatment of certain forms of fibrositis. Particular mention may be made of subacute or chronic fibrositis of the shoulder, chronic lumbago, and so-called lumbo-sacral and sacro-iliac strain, and chronic foot strain, giving rise to pains in the legs, knees and thighs. This, however, necessitates a specialized technique, and it would be out of place to describe it in detail in the present article.

Local injection of certain drugs is of particular value in the treatment of certain rheumatic conditions. The work of Sir Thomas Lewis and of J. H. Kellgren on the artificial production of muscle pain by the injection of hypertonic saline solution has helped to put long-standing clinical impressions on an experimental basis. Recently James Cyriax has described how, by injection of 0.1 c.c. of a 4 per cent. solution of sodium chloride into various points in the occipital, temporal, and the posterior and lateral cervical muscles, and into the epicranial aponeurosis, pain was always produced at the site of the injection and had a well-defined distribution.

Irritation of the fibres of the posterior cervical muscles close to their occipital insertion, and of the occipitalis itself, gives rise to pain running forwards like a band encircling the head and reaching its maximum intensity in the temple and forehead over the eye. Injections into the epicranial aponeurosis set up pain referred to the eyes, behind the eyes, and in the eyeballs and eyelids.

Painful points in bone have been recognized for a long time, but recently Professor Raffalae Bastianelli has pointed out a suprahumeral point—a point on the head of the humerus, under and a little to one side of the coracoid process. This point is situated just outside the joint capsule where the inferior attachments of the coraco-humeral ligaments are situated. This is a common cause of severe shoulder pain, and of limitation of active and passive shoulder movements. The pain may be localized or referred to the anterior and posterior aspects of the shoulder, to the scapula and along the arm. The condition is usually incorrectly diagnosed as an arthritis or fibrositis of the shoulder. Pain localized in the tip of the styloid process of the radius is common, especially in women. The patients complain of pain in the wrist, chiefly during dorsal or ulnar flexion of the hand, in abduction of the thumb or in grasping an object, or of pain running down the dorsal aspect of the thumb or hand, or radiating up into the forearm.

In the lower limb, a common tender point is on the external tibial condyle, anterior and underneath the articular surface. Pain is referred from this point to the knee and to the leg in such a way that patients speak only of the referred pain and often cannot locate the exact site of the pain.

The ilium and the sacral region near the sacro-iliac joint often present tender points from which pain is referred to the buttocks, the waist and the abdominal wall. The exact causation of these tender bone areas is not known. The periosteum, the fibrous attachment to the bone or overlying muscles, may be the structure responsible for the pain.

The point which it is necessary to emphasize is that a careful clinical examination must be undertaken and a differential diagnosis made to eliminate certain of the generalized forms of muscular rheumatism. Then a careful examination will often allow the recognition of these tender points. Mr. R. H. Young has studied these extensively at St. Thomas's Hospital. It has been my experience now for some years that injection of 5 to 20 c.c. of ½ to 1 per cent. novocain into such an area will frequently give dramatic relief both of pain and muscle spasm. One or several areas may have to be injected before there is a satisfactory clinical result. A 1 in 50 solution of procaine in olive oil or a 1 in 200 aqueous solution of procaine, or 1 to 20 drops of a 3 in 100 solution of phenol may also be used. It is my experience that the so-called fibrositis of the shoulder area, of the elbow and of the sacro-iliac region are particularly liable to respond dramatically to this form of treatment. When facilities are available, two or three applications of radiant heat and gentle faradism to the muscles of the affected part may hasten complete relief of symptoms. It is because, in my opinion, this is such a very important advance in the intelligent application of physical measures that I place what may seem to be undue emphasis on this form of treatment.

Which of the above-mentioned physical measures should be employed in the treatment of the individual patient naturally depends on the facilities available. The spa practitioner will tend to employ primarily the various forms of hydrotherapy; the physician in charge of the physical medicine department of a general hospital will favour massage, radiant heat, and the various forms of electrotherapy; the medical officer of a municipal clinic will use actinotherapy; and the orthopædic surgeon will prefer manipulation, postural exercises and splinting. The general practitioner usually makes use of liniments, electric pads and strapping. He should familiarize himself with the technique of novocain injections as, by their use, he will frequently obtain, in selected cases, results comparable with those of a well-equipped physical medicine department.

The more elaborate methods of treatment are not always obtainable. The patient cannot always afford the time and money to attend a specialized clinic, but usually he is able and willing to undergo a careful clinical examination by his doctor and to carry out the simpler physical measures to which reference has been made.

PHYSIOTHERAPY IN CONVALESCENCE AND GENERAL DEBILITY

By MARY E. ORMSBY, M.R.C.S., L.R.C.P.

Clinical Assistant, Light Department, Royal Northern Hospital, and Assistant, Physical Treatment Centre, St. Marylebone & Western General Dispensary.

CONVALESCENCE

CONVALESCENTS are in a different category from that of debilitated patients not recovering from acute illnesses. The primary cause of the convalescents' trouble is past, the ensuing disability may arise from such various causes as trauma, shock, pain, weakness and malnutrition and, sometimes, there may be need for adaptation to a modified mode of life.

There is, for example, the patient who has had a long and painful illness followed by a severe operation, and who, though having had the root of his trouble eradicated, is left feeble, possibly crippled, and with a wound which does not readily heal.

Physiotherapy has a part to play in the attendance to each weak link in the chain of illness. Feebleness calls for rest of mind and body at first, and for the toning up of flabby muscles and promotion of better metabolism later.

The patient's weakness oppresses his spirits and he is apt to feel that he can never be well again; he may need to be reminded that his present " jaundiced outlook " has a physical basis and to be encouraged to discount to-day's valuation. At the same time he may be taught how to relax his muscles, and he should be made thoroughly comfortable in bed, both with regard to pillows and position. His muscles are in poor condition, easily strained and fatigued. Back and feet need to have strain removed, the back by ring or pillow, and the feet by a firm pillow against the soles so that the feet may be at right angles to the legs, and possibly by the use of a cradle, so that the pressure of the bedclothes is relieved.

Then, as the patient gains ground, massage, progressive muscular relaxation and bed exercises may be combined, and warm immersion-baths given to promote both relaxation and sleep. The demands of pain and muscular weakness can, in addition, be met by infra-red rays, faradism and diathermy. The secret is to work as nature does, by slow degrees and not to " whip a tired horse."

General ultra-violet baths often prove of use; exposure should be carefully graduated, *e.g.*, a suberythema dose to the legs, followed next day by a similar dose to the arms, and so on. Sleep is usually better, appetite improves and the patient feels " better in himself."

Local ultra-violet irradiation is mentioned later in connection with wounds.

There are patients with muscular disabilities who need physiotherapy *early* in their convalescence, *e.g.*, the patient who has had a severe breast operation and needs massage, movement, and carefully graduated arm-exercises if she is ever to obtain the fullest possible range of movement.

Ultra-violet irradiation accelerates the healing of wounds and helps in the obtaining of better scars. This treatment should not be delayed, and should be local, *e.g.*, a patient who has had an operation for cervical adenitis can begin with small daily treatments the third day after the operation.

As the convalescent improves, occupational therapy is indicated, the occupation being chosen with regard both to physical powers and requirements, and to mental

outlook—coaxing of muscles, practice in co-ordination, and plain congenial work. The soothing effects of rhythm are great. Short shifts of work and rest produce the best results with the least fatigue. There is a wide field for occupational therapy in surgical tuberculosis.

Reading will naturally be a great solace and entertainment to many, but I would plead for wisely chosen books, not enervating and sentimental, but stimulating and wholesome. Mental fare is poisonous or good, as is food, and it is sometimes forgotten that some help may be given in supplying books which are suitable to the illness and to the type of patient. After all, what a patient reads provides a large part of his atmosphere while he is tied to his couch. The rhythm of being read to aloud is sometimes useful in allaying restlessness and promoting sleep, and a reader saves the patient's eyes and energy.

GENERAL DEBILITY

Patients who are not convalescent and who are suffering from general debility fall into several groups.

These are the unstable type of patients in whom no recognisable cause has been found answerable for their trouble. There are those suffering from overwork or worry. General ultra-violet irradiation, nourishing food, rest, and exercise are useful measures to be used while a search is made for the cause of the trouble and means for a better mode of life.

In Chronic Infections. Another group are victims of chronic infections, e.g., sinusitis, non-pulmonary tuberculosis and so forth. Again ultra-violet irradiation is often a powerful ally, and tonics that combine well with ultra-violet rays (e.g., iron, arsenic, etc.), have their place.

In Malignant Disease. Sometimes the debilitated victims of malignant disease can be helped by physiotherapy. It is true little can be done in the way of treatment, but that little is well worth while, because the patient feels that something is being attempted and that he may be tided over an interval till a "cure for cancer" is found. Moreover, ultra-violet irradiation does make septic wounds cleaner; it is usually best to avoid heat and to use a filter reducing the range to that of sunlight. Skin previously treated with radium, and hence with defective blood supply, requires care in treatment; e.g., a shield of paper or grease may be applied to protect the skin near the actual wound, or more moderate doses may be given to the surrounding skin than to the wound itself.

In Rheumatoid Arthritis. Another group of patients, those suffering from rheumatoid arthritis, are best treated away from home, unless, as is rarely the case, they can have unbounded rest and care there. Treatment includes rest, fresh air, easily digested and nourishing food and freedom from worry. Affected joints should be protected from any movements which strain and fatigue damaged structures; light comfortable and easily removable splints (e.g., of reinforced leather), secure rest and prevent deformities. The discreet use of wax, massage, infra-red rays and medical electricity improves the circulation and reduces spasm. Re-education and the toning up of weak muscles come later, and here wisely-supervised occupational therapy comes in. General ultra-violet irradiation often improves the patient's condition and, when given locally, helps the circulation in the extremities. Dosage must be controlled by the condition of the patient, and it is usually well to give short exposures to limited areas every other day. The sedimentation rate, hæmoglobin estimation, X-ray appearances and careful clinical investigation supply means of assessing progress and directing further treatment.

One more group may be considered and that comprises "incurables," cases of paralysis and functional nervous disease, cripples and others. These patients value

even a slight improvement in general health and function, and once more ultra-violet irradiation, massage, hydrotherapy and medical electricity have their uses.

Much has been written about the diet of convalescents and patients suffering from general debility. I can only say "feeding up" calls for much imagination and patience. Efficient digestion for food has to be secured before the food can be utilised, and after all the patient's requirements are not great at first. Small simple meals at frequent intervals, with plenty of fruit juice and water between them, prepare the patient for the time when appetite returns and more solid fare can be digested.

Sleeplessness is a complaint which has a considerable literature of its own, but I would like to remind readers how useful hydrotherapy, massage and bed exercises may be in some cases. Progressive muscular relaxation both promotes sleep and gives rest even when sleep is unobtainable. I have found the following method of combating sleeplessness useful in both adults and children. The patient must be possessed of intelligence and grit. He selects (or has selected for him) some interesting book which does not raise complexes by referring at all to his immediate life and problems (e.g., the early parts of Trevelyan's " History of England," " Bevis," by Richard Jefferies, or some novel of less complicated times than our own). When the patient is comfortably in bed, with a light near him which he can extinguish without trouble, he reads a few pages of his book. He then lies comfortably and pictures the scenes about which he has read, and does not allow his mind to wander away to the problems and perplexities of his own life. At first the " game " may prove difficult, but perseverance usually brings a substantial measure of success.

Convalescent Homes equipped with the apparatus and personnel for physiotherapy offer great advantages over those not so equipped. Under careful medical direction these added means of treatment may hasten recovery and help in sending the patient back to work with muscles in good order. To merely feel well is one thing, and to be, as it were, in training is another.

As in all other walks of life the individuality of those caring for the convalescent is of supreme importance. Imagination, sympathy, and discretion are as much needed in the care of the convalescent as skill is needed in coping with any delicate mechanical apparatus that is out of order.

I ask to be forgiven for these platitudes; they are written to remind us that, to many patients, convalescence is the hardest part of an illness.

PHYSIOTHERAPY IN NERVE AFFECTIONS—*contd. from p. 103*

personality and the use of suitable equipment, care being taken that the patient does not rely unduly either on his teacher or on material supports. It is only the quack who will wish the invalid to remain for ever dependent on himself and constantly in awe of dramatic apparatus.

(4) Finally, the aim should be to increase the patient's activities steadily, but gradually, without any relapses due to over-fatigue, or mental discouragement.

If these aims are followed the worker will seldom fail to restore even the worst cases to a certain measure of enjoyment of life, and usually also to remunerative work.

PHYSIOTHERAPY IN SKIN DISEASES

Following upon the publication of the special series of articles by Mr. W. Sayle Creer, F.R.C.S., on " Physiotherapy and Orthopædics," which was concluded in our March issue, we are pleased to announce that the next series of papers concerning Physiotherapy in the Specialities will be written by Dr. Robert Aitken, F.R.C.P., and will deal with " Physiotherapy in Skin Diseases." This series will be commenced in our July issue.

Obituary

ELKIN P. CUMBERBATCH, M.A., M.B., B.CH. (OXON), F.R.C.P., D.M.R.E.

THE death on March 24th, at the age of 58, of Dr. E. P. Cumberbatch, Medical Officer in Charge of the Electrical Department at St. Bartholomew's Hospital, is a great loss to Electrotherapy.

He was the son of Charles Cumberbatch, of Queen Charlton, Somerset, and was born there in 1880. As a student he was brilliant; he was a senior foundation scholar of St. Paul's School and left with a senior entrance scholarship to Keble College, Oxford, where he obtained an open Science Scholarship. He took first-class honours in the final School of Physiology and went on to St. Bartholomew's Hospital as Senior University Scholar. After being house-physician at St. Bartholomew's he became demonstrator of physiology in the medical school and chief assistant in the X-ray Department. When X-ray work was separated from the old Electrotherapeutic Department in 1912, Cumberbatch was put in charge of the Electrical Department.



One of Cumberbatch's great contributions was the establishment of a standard orthodoxy. This he did by his teaching and his books; and this work was all the more valuable because it was done at a time when the physiological effects of currents were misunderstood and unjustifiable claims were being made. When diathermy began to be used for purposes other than surgical coagulation, he was a supporter of the view that its results were due solely to heat—an opinion which was opposed to the Continental teaching. More recently he championed the same view with regard to ultra-short wave diathermy.

He was an enthusiast and was always anxious to impart his enthusiasm to others. His writings include the two books, "The Essentials of Medical Electricity," and "Diathermy," and his contributions to "The Encyclopædia of Medical Practice," the "Archives of Radiology and Electrotherapy," of which he was joint author, the "Lancet," the "British Journal of Physical Medicine," and other journals. He

was patient and painstaking in his teaching. The lucidity of his books bears witness to his untiring efforts to render the subject simple. He always attempted to visualize rather than give mathematical expression to the more technical aspects of the subject. He knew that such visualization was the only way he could impart these to the bulk of his readers; and only those who have tried to do the same thing can know what tremendous labour this involves. He was an experienced and fair examiner and by his kindly manner never flurried the examinee. He was associated in this capacity with the D.M.R.E. from its inception in 1920.

Cumberbatch was a master of the art of nerve testing and it was a real pleasure to see him at this work. The foundation of his mastery was the four years' experience he had at the First London General Hospital during the War. He never accepted condenser testing owing to the fallacies connected with it and to the fact that in his hands the method of faradism and galvanism was superior. The condenser method was introduced in order to obviate as far as possible the personal factor, but, when Cumberbatch was the operator, the personal factor was something it was desirable to retain.

In 1921 Cumberbatch was President of the Section of Electrotherapeutics of the Royal Society of Medicine; in the following year he presided over the Section of Electrology at the Bilingual Congress in London; he was a member of the Council of the Röntgen Society and of the British Association of Radiology and Physiotherapy; in 1933 he was the first in his speciality to be elected an F.R.C.P., and in 1936 he was President of the Section of Electrotherapeutics at the Sixth International Congress of Physical Medicine in London.

Many will miss the cheerful welcome he always extended to visitors to his Department, and the enthusiastic instruction they received there. His ready encouragement, geniality and unruffled temper endeared him to all, and he was a staunch friend. Dr. Cumberbatch leaves a widow, a son and daughter.

C. A. ROBINSON, M.A., M.B.(Cantab).

The science of electrotherapy has indeed suffered a great and heavy loss by the death of Dr. Cumberbatch, and no section will feel it more keenly than the medical auxiliary physiotherapists. His obvious love of the subject, of which he was a master, his gift for imparting his knowledge to others, his patience and the sympathetic interest he showed towards our profession made a great impression on all those who came into professional contact with him. As a friend and pupil, I shall always remember him as a man of unassuming manner and of lovable character. The Society of Physiotherapists, on behalf of its members, wishes to express the sorrow that they feel at the passing of a great teacher and a true friend. We shall always cherish the fact that one of his last lectures was delivered to our Society on the occasion of its Annual Meeting in October, 1938.

M. VAUGHAN-COWELL, C.S.M.M.G., B.P.A.

Vice-Chairman,

THE SOCIETY OF PHYSIOTHERAPISTS

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

Treatment of Herpes Zoster by U-V-R

A. Devois and Ch. Proux (Abstr., *Centrlbl f.d.g. Radiol,* 1939, xxix, 222) report their results of treatment of 100 cases of shingles, which they divide into three groups. (1) The herpes had lasted for 5 days; (2) for 12 days; and (3) for more than two weeks. In the first two groups, u-v-r was employed; in the third, chiefly X-rays. A mercury-quartz lamp was employed for the first treatment, at a distance of 60 cm. for 6 to 8 minutes, and subsequently 10 to 12 and 15 minutes. All in the first group, which comprised 30 cases, were cured. In the second group only two required X-ray therapy. In the third group, results were expected from u-v-r, only if eruptions were still present.

Hyperpyrexia by Short Waves and Hot Baths

H. A. Scholtz (*Deuts. med. Woch.*, 1938, ii, 1290) compares hyperpyrexia produced by hot baths with that obtained by short-waves. The bath was brought in 35 minutes to 43°-45° C., and after this temperature had been reached the patient was taken out and wrapped in a pack for an hour. When using short-waves, a generator of 600 to 800 watts, or two of 300 to 500 watts was employed. The body temperature was taken every ten minutes in the mouth until a temperature of 39° to 39.5° C. was reached, generally after 40 minutes. The patient remained in the pack for one hour, and was then placed in another for a further hour. The treatment by the short-waves was better borne and the heating lasted longer.

Fever Therapy in the Treatment of Syphilis

A. J. Kotkis (*Jour. Miss. State Med. Assocn.*, 1939, xxxvi, 57) considers that fever therapy, properly combined with chemotherapy, is the treatment of choice for general paralysis. In tabes dorsalis, fever therapy and chemotherapy play a lesser rôle. The crises and pains are often amenable to these measures and transitory incontinence is often cured. In cerebro-spinal syphilis, cases refractory to chemotherapy alone often respond to fever therapy and chemotherapy. Primary chancre and the secondary stage of syphilis do not require fever therapy. In cases with a persistent positive Wassermann reaction, a large number respond satisfactorily to fever treatment and chemotherapy.

Sunlight and High Altitudes in Non-Pulmonary Tuberculosis

A. Rollier (*Med. Welt.*, 1938, xii, 842) states that the results of heliotherapy depend on an exact dosage and technique. Heliotherapy should always have a decongestive action: it should always begin at the feet and then progress gradually upwards, until the whole body except the head is treated. In addition to sunlight, orthopœdics was applied at his sanatorium, and the patient given work to do. The last year's statistics at Leysin were as follows: cured, 80 per cent.; much improved, 16 per cent., stationary, 3 per cent.; died, 1 per cent. The average duration of treatment was 19 months for spondylitis, 20 for coxitis, 25 for gonitis, 21 for tuberculosis of the foot, 17 for tuberculosis of the shoulder, 16 for tuberculosis of the elbow, and 14 for tuberculosis of the hands. Of the patients, 85 per cent. were discharged able to undertake full work, and 15 per cent. able to do partial work.

Investigations in Fever Therapy

F. H. Krusen and E. C. Elkins (*Arch. Phy. Ther.*, 1939, xx, 77) recommend treatment by sulphanilamide alone, before fever therapy is employed, in cases of gonorrhœa. For those who did not respond to this form of treatment alone, fever therapy was combined with it. At first, 80 grains of sulphanilamide were given each day for two days. On the third day, after a preliminary conditioning treatment, the patient was given a single ten-hour fever treatment. Of those who received the combined treatment, 95.5 per cent. showed evidence of apparent remission of all symptoms. The authors recommend the intermittent use of oxygen and carbon monoxide during the session of fever. Before submitting the patient to fever therapy, the case should receive a preliminary short treatment, 12 hours prior to the long one. In the case of women, diathermy to the pelvic

region was applied and was found valuable. A thermometer for registering the patient's temperature should be in constant use: high humidity in the cabinet should be maintained: the intravenous injection of a 5 per cent. solution of dextrose in physiological saline solution should be employed before, during, or after treatment, and special windows should be made in the cabinets to allow the nurse to watch the patient at all times.

Hyperpyrexia in Nephritis and its Complications

G. W. Stark (*Arch. Phy Ther.*, 1939, xx, 94) employed the following treatment in cases of nephritis: Short-wave therapy was used, with the electro-magnetic coil centred above the upper abdomen, for the first half of the treatment and over the lower back for the second half. The equivalent of six thicknesses of Turkish towelling was introduced between the coil and the skin. The patient was covered with sheets or blankets and the perspiration wiped off at suitable intervals. The rectal temperature was taken every 15 minutes (it should not exceed 102°-103° F. and the skin under the electrode should not become too moist). A piece of towelling was placed between the feet. The duration of the treatments was gradually increased to one hour twice daily, with, if considered advisable, a third application at midnight. Induction therapy was not employed during the acute febrile stages and was contra-indicated in cases with marked toxæmia and obstruction in the ureter or lower urinary tract. Calcium was given in most cases, with iron, vitamins, sunlight and exercise. The loss of fluids by the perspiration was replaced by 10 per cent. glucose. Clinical improvement was noted in many of the 36 cases treated with deep induction therapy. Cases are described to show the value of this form of treatment.

Fever Therapy in Chronic Myositis of Lumbar Region

H. B. Shorbe (*Arch. Phys. Ther.*, 1939, xx, 102) used hyperpyrexia in four cases of myositis or fibrositis. In one case two treatments of hyperpyrexia were given, eight days apart. The oral temperature was brought to 104.8° F. The temperature of the patient before the treatments had been varying between 99.6° F. and 100° F. daily. After the first treatment the temperature remained normal for three days, and after the second for four days, with some relief from pain, but later the temperature returned to its previous level. The other three cases received marked improvement from a similar treatment.

Heliotherapy and Climate in Bacillary Peritonitis

A. Rollier and W Lurba (*Technique Chir.*, 1939, xxxi, 1) have treated chiefly serous, sero-fibrinous, fibrinous adhesive, caseous and fibro-caseous forms of peritonitis. They lay particular stress on the error of exposing the abdomen to the sun at the beginning of the treatment, which should be commenced with the legs; the abdomen should never be treated until at least one hour's exposure of the legs is borne without any sign of intolerance. The authors give the statistics for the years 1927 to 1937. Of 177 cases treated, 66 suffered also from pleuro-pulmonary lesions, 25 from lesions of the adnexa, and 11 from lesions of the cæcum and appendix. Of the 177 cases, 65 had been operated upon, 14 for affections of the adnexa, 48 for appendicitis, 2 for acute peritonitis and 1 for intestinal obstruction. Results: cured, 138; improved, 26; stationary, 6; aggravated, 2; and died, 1.

Evaluation of Skin Protection Against Ultra-Violet Rays

A. Bachem and B. Fantus (*Arch. Phys. Ther.*, 1939, xx, 69) studied the protective values of ointments against ultra-violet rays. They found that yellow petrolatum, wool-fat petrolatum mixtures, cream salve and diachylon ointment were much better protectives than tragacanth paste, vanishing cream, cold cream and white petrolatum. Cream salve gave the best results; this is an emulsion of water, 50 parts, wool fat one part, and petrolatum 3 parts. Insoluble powders were also studied, and it was found that titanium dioxide had the highest protective value and calamine the next highest. Barium sulphate was less efficient. Ichthyol had a protective value in as low a concentration as 2 per cent.

Endovascular Diathermy for Cirsoid Aneurysm

H. Donovan (*Brit. Med. Jour.*, 1939, i, 416) describes the case of a girl, aged 14 years, suffering from a pulsating cirsoid aneurysm of the right two-thirds of the upper lip. The facial artery was divided and a small diathermy electrode was inserted into the distal segment. A moderate current was turned on and the electrode slowly withdrawn. The angiomatous tissue was then excised from the lip. An examination after seven months suggested angiomatous tissue in the mucous membrane of the margin of the lip, but there was no pulsation. The method was recommended for further trial.

REVIEWS of BOOKS on Physical Medicine and Allied Subjects

The Science and Art of Joint Manipulation

The Science and Art of Joint Manipulation. By James Mennell, M.A., M.D., B.C. Volume I. 233 pp., 284 illus. Price 18s. London, 1939: J. & A. Churchill.

The above is the first of two volumes of a work, of which the second volume (on the vertebral column) is to appear later on. The author, who has done so much to place on a scientific basis what is commonly known as "bone-setting," and which until recently was practised almost exclusively by bone-setters and other irregular practitioners, in the above volume embodies much of his knowledge of the science and art of joint manipulation of the extremities.

After an introductory chapter the author proceeds to describe "joint lesions," and treats the subject specially from the point of view of limitation of movement due to causes which can be overcome by joint manipulation. Perhaps in this connection more space might have been devoted in order to impress upon the reader the inadvisability of attempting to mobilize tubercular joints.

After a chapter on "Referred Pains from Joints," he proceeds to consider, in another chapter the "General Rules for Joint Manipulation." These may be summarized by saying that it is better to mobilize a stiff joint gradually, securing a relatively small improvement at each sitting, thus nearly always obtaining a real and continued improvement, than to attempt too much at one sitting, which may result in inflammatory reaction and so make matters worse than they were before.

One is glad to see that the author repeatedly describes manipulations that involve movements *not* under voluntary control (such as antero-posterior movement of the wrist on the radius, and antero-posterior movement of the tibia on the femur), a part of the art of "bone-setting" which is hardly appreciated at all. When describing passive elongation of joints, the author speaks of this as "tension"; whereas "traction," a term already in use, seems more descriptive.

He then proceeds in detail to describe the technique of the manipulation of every joint in the upper and lower extremities, and illustrates this by photographs. He perhaps does not sufficiently stress the importance of rapidity of movement in his mobilizations, but, it is of course well known that success here so largely depends upon what may be termed "catching the affected joint unawares." Although naturally it is impossible to acquire the science and art of joint manipulation from a textbook, yet this volume will prove of the greatest assistance to students of joint manipulation who are uncertain of how they are to proceed in any given case.

It is to be hoped that this book, in addition to being a *vade mecum* as regards technique for students of joint manipulation, will serve to bring to the notice of the medical profession the possibilities concerning such treatment—possibilities which are in all probability far greater than the average practitioner realizes—and that there will be an end to all those irregular practitioners who, although they no doubt have cured some cases, have in numerous others inflicted serious and irreparable damage.

EDGAR CYRIAX.

Orthopaedic Appliances

Orthopædic Appliances. By Henry H. Jordan, M. D. 412 pp., 176 illus. Price 2 /-. London, 1939: Oxford University Press.

Once again an American has written a detailed treatise on a highly technical subject in language which reads easily and delightfully and which can be understood by anyone who has had a reasonable education. Dr. Jordan is to be congratulated on the style, scope and arrangement of "Orthopædic Appliances," which is published in England in a very pleasant form by the Oxford University Press. The subject matter is based on what is very evidently a wide experience. He mentions that he has made and fitted 15,000 pairs of foot supports. The opinion of a man of this calibre cannot be dismissed lightly, even if we disagree with his theses.

In the foreword by Dr. Brackett, and in the Author's preface, it is clearly stated that the book is an attempt to present in one volume an account of the principles of the use and the method of construction of supports, braces, and other orthopædic appliances in such a way that others may avoid the pitfalls and mistakes which beset the inexperienced. It is profusely illustrated by half-tone reproductions as clear

as photographic prints, and by line drawings, many of which are masterpieces of effective simplicity. The type is clear and restful. The regional division of the subject matter, and the indexes, make it possible to find any particular with the greatest of ease. The crowning service to the reader is a glossary of American terms not familiar to everyone on this side of the Atlantic.

One feels almost that, with this book to guide one, the production of comfortable and efficient appliances is easy. To British orthopædic surgeons it will seem strange that they should be expected to take so much interest in the small details of construction, for they have at their command a sufficient number of expert technicians to instruct whom would be invidious. It is realized that there is a different relationship between physician and bracemaker in the United States and that " conferences " between them are common in order to be sure of achieving the desired result.

The book's greatest usefulness will be in districts or in countries where the surgeon has to rely on the work of less skilful instrument makers or has to construct his own appliances. One might say that it will be invaluable to such, as well as to all surgical instrument makers, as a book for constant reference and for stimulation.

But it may be surprising to the conservative English mind which has been taught by the written word and by direct experience in American hospitals, to find such a plethora of appliances being used. America, we thought, is the one place where every effort is made to replace splints and braces by some operative procedure. Surely Great Britain has not outstripped her enterprising cousins without it being noticed! Perhaps the most important reason for the desire to get rid of braces in Britain is that we believe that very few appliances designed for ambulatory support of the lower limb can be satisfactory; that the spinal problem hardly exists for us; and last, but not least, the lack of the sixth of the author's basic requirements for efficient bracemaking—" the intelligent use by the patient."

The author appears to appreciate these points, for the latter part of his introduction is almost an apology for laying so much importance on the appliance, and even constitutes an appeal for the resurrection of a superseded art. But there is more in it than that. Those who have studied medical problems are very strongly impressed by the strange differences which face the profession in the two countries. Paralytic deformities are a curse in the U.S.A., but of negligible importance in Britain. The cost of appliances is a fundamental consideration in Great Britain, but of much less moment in America. In comparison with America, flat foot does not exist in Britain. In Britain traumatic surgery appears to bulk much more than what one may term true orthopædics. The number of patients seen daily by each surgeon in Britain is larger than that in America, and it is utterly impossible to devote as much time to the personal fitting of appliances; the bracemaker does much that the American orthopædic surgeon carries out himself.

Nevertheless the book is helpful in many ways. It deserves to be read for its merits as a classic dissertation, and for its complete lack of bias; for the fact that the reader is shown in detail the reason for every step in procedure and every detail of construction. If one does not agree with the reasons for the use of any appliance discussed, at least one has to agree that it is described in a masterly way.

W.S.C.

Physical Therapy in Arthritis

Physical Therapy in Arthritis. By Frank H. Krusen, M.D., Associate Professor of Clinical Medicine, The Mayo Foundation, University of Minnesota; Head of the Section of Physical Therapy, The Mayo Clinic. With Foreword by Melvin S Henderson, M.D. 180 pp., 21 illus. Price 9s. New York, 1937: Paul B. Hoeber.

Dr. Frank Hamond Krusen's book, " Physical Therapy in Arthritis," is an attempt to overcome one of the difficulties with which the general practitioner is faced. The book contains much useful information and many ingenious gadgets.

One feels that the writer is treading on very dangerous ground in advocating so strongly that " the majority of physical measures used in the treatment of arthritis may, with a little thought and effort, be applied quite readily in the patient's own home."

Most of the home treatments advocated are not carried out by the patients themselves but by some other person, and on page 148 the writer states that it is possible in most instances to teach a member of the patient's family to perform certain simple massage movements which may be beneficial.

Whatever may be the value of massage in the

Contd. at foot of p. 122

EMPIRE RHEUMATISM COUNCIL

On Tuesday, 25th April, at 3.30, a meeting is being held at the Mansion House in support of the work of the Empire Rheumatism Council. H.R.H. the Duke of Gloucester will address the meeting, and in a letter written to Lord Horder he has expressed the hope that the meeting will help to awaken the community to the need for grappling with the scourge of rheumatic disease, which causes so much human suffering and economic loss.

AMERICAN PHYSIOTHERAPY ASSOCIATION ANNUAL CONVENTION, JUNE, 1939

The 1939 Convention of the American Physiotherapy Association is being held at the Cosmopolitan Hotel, Denver, Colorado, from 25th to 30th June. Although Denver is some distance west of Boston, where the Convention was held last year, it is the gateway to some of the most scenic country in the United States, and therefore makes it possible to combine convention activities with vacation trips to the national parks. As in the case of last year, a very interesting and full programme of lectures and visits to hospitals has been arranged. In a letter to The Society of Physiotherapists, the American Physiotherapy Association extends a cordial welcome to British physiotherapists to visit this Convention, further particulars of which may be obtained from the Association, 2065, Adelbert Road, Cleveland, Ohio, U.S.A.

Review of Books—*Contd. from p. 121*

treatment of arthritis, such a doctrine is extremely dangerous. In suggesting home treatment by heliotherapy, experience goes to show that patients are very prone to over-expose themselves or to prolong the treatment so that harm results.

One finds it difficult to visualize the successful application of electrotherapy being carried out in the average home of the British patient.

Apart from the doctrine of home treatment advocated, this book provides a good review of the many physiotherapeutic methods, and is a concise collection of opinions of many well-known authorities. It is a book that should be in the hands of the general practitioner only, otherwise its objects will be defeated and the methods outlined in it will be adopted inefficiently, with the result that physiotherapy will lapse into disfavour. W. B.

EMANOTHERAPY WITH "RADIGAM" APPARATUS

Apart from the high-dosage methods of applying radium, which are necessarily restricted to institutional or specialist use, the great therapeutic value of radium may be safely utilized, in the form of emanotherapy, by all who are concerned with the science of healing.

We have received from The Radium Spa an interesting booklet describing the Radigam apparatus, the various forms of which provide for the employment of emanotherapy—or mild radium therapy—in a particularly convenient manner. Especially interesting is the ingenious "Radigam" Emanator. In its simplest form, which can be easily carried in the pocket or hand-bag, it consists of a small perforated ebonite tube, in which is a linen bag containing an insoluble radium salt which is guaranteed to be free from the rapidly-disintegrating mesothorium. When the emanator is placed in water the latter percolates through the perforations and takes into solution the radon emanating from the radium salt. Thus, after a few hours immersion, the water becomes highly radio-active. The radium salt employed being insoluble, there is no loss of radio-activity after continuous use.

The preparation of radio-active water, comparing favourably with that of the various famous Spas, is thus easily and cheaply carried out in the home. The first cost of the apparatus is the last, as no replacements are subsequently necessary. The uses of radio-active water prepared by the "Radigam" Emanator, and of other methods of applying mild radium therapy, are fully described in interesting literature which will be gladly supplied to readers of the *Journal* who apply to The Radium Spa, First Avenue House, High Holborn, London, W.C.

LOW INTENSITY SHORT-WAVE THERAPY

We are asked to announce that the apparatus for low intensity short-wave therapy (L.I.T.) may now be inspected in London, as well as at Bournemouth, as previously. The London office is at 17, Nottingham Place, London, W.1, and enquiries should be addressed there to the L.I.T. Co., Ltd.

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Original articles are invited on any aspect of Physical Treatment. Such articles are published only on the understanding that they are contributed exclusively to this Journal, *which does not hold itself responsible for statements made or opinions expressed by any contributor. The copyright of all articles appearing in the* Journal *is strictly reserved.*

Achievement

THE Physiotherapy Department of the new Westminster Hospital, described on page 142 of this issue, is a token of the progress in physical medicine in Britain—for not only is this described as being rationally placed but also as a large, airy, spacious and well-lighted Department equipped to give all forms of physiotherapy. It is noteworthy, too, that the equipment is all-British, and, while we know and fully appreciate the valuable research on theory and design of apparatus, and its clinical applications, which has been carried out abroad, we are pleased to note that this newest of Physiotherapy Departments is so equipped. Another interesting fact concerning it is that its auxiliary staff is exclusively composed of qualified physiotherapists.

Progress in physiotherapy in this country, as we have so often pointed out, is slow, and its value by no means fully appreciated by many hospitals and municipalities or by the medical profession generally, a fact which has been continuously deplored by those who have proved for themselves what a valuable therapeutic weapon physiotherapy can be. But, if we glance back over the last decade and note the signal advances made in some quarters during that period, we cannot feel wholly discouraged. During those ten years several of the London hospitals have either rebuilt or established physiotherapy departments, and much valuable work in the same direction has been done in provincial hospitals. Clinics, both municipal and private, and either exclusively or partly concerned with physiotherapy, have been established in many parts of the country. To instance only a few we would mention the Physiotherapy Department of the London Hospital; the British Red Cross Clinic for Rheumatism; the L.C.O.C. Clinic for Rheumatism; the new Solarium in Bermondsey; the Woolwich Health Centre; the Dartford Massage and Light Clinic; and the New Ollerton Electrical Clinic.

This period has also seen the establishment of the Physical Medicine Group within the British Medical Association and the Physical Medicine Section of the Royal Society of Medicine, as well as the holding of the Sixth International Congress of Physical Medicine in London. It has seen the inception of the Roll of Bio-Physical Assistants and the subsequent establishment of the Board of Registration of Medical Auxiliaries which has given to the medical profession a reliable Register of qualified medical auxiliary physiotherapists who can efficiently administer the various forms of physiotherapy under medical direction or on medical prescription. There are other advances which will come to the mind of those acquainted with the history of physiotherapy, but these will suffice to remind us that physical medicine in Britain

Contd. on p. 126

PHYSICAL THERAPY IN ORTHOPÆDICS

By KURT HULDSCHINSKY, M.D. (BERLIN)

Alexandria, Egypt

ORTHOPÆDIC treatment comprises the following measures: (*a*) prevention and treatment of diseases, which may give rise to deformities or disturbances of locomotion (e.g., tuberculosis, poliomyelitis, rickets, etc.); (*b*) prevention and treatment of deformities during the illnesses (e.g., by complete rest in recumbent position in tuberculosis of bone); and (*c*) removal of deformities already present (e.g., operation for paralysis or for correcting bony deformities).

In these three classes of orthopædic treatment, physical therapy plays an important part. It is not intended in this paper to give a complete survey of all the curative physical methods employed in orthopædics, but rather to place before the medical practitioner those recognized physical methods which must or can be employed in certain diseases, so that he may neglect no means of assisting his patients. It is not suggested that it is necessary that every doctor should use the methods himself or should possess the necessary apparatus. Such does not always fit in with his other work, and, where the services of a specialist are available, it will often be preferable to entrust the treatment to him. Nevertheless, every medical practitioner should know what measures should be taken and how they should be employed.

The physical methods used to-day in orthopædics comprise the whole field of physical mechanics, optics, thermostatics, and electricity; even acoustics are employed as aids in the rhythmic movements of orthopædic gymnastics, and help to raise the muscle tone through the influence of the mind.

Mechanics.—This comprises in the first place manipulations, which are measures intended to correct static disturbances. An attempt is made to correct defective posture by improving the joints, by massage of the appropriate groups of muscles, or it may be, by inducing too strongly contracting muscles to rest by uniform stimulation, or to strengthen weak muscles by promoting a good supply of blood. Contracted joint capsules are stretched by passive movements, and painful contractions may be cured by soothing stroking. Here massage of nerves comes in, and the method can be used in neuralgias and myalgias, thus preventing contractions or paresis, and removing disturbances already present.

The so-called medico-mechanical treatment no longer plays an important part, and has hardly been able to maintain its position against manipulations. In gymnastics we now use very little apparatus but include Glisson's extension, the inclined plane, the ladder, and the neck "see-saw" or "swing" (Nackenshankel). Extension by weights also is to-day much employed. To stretch contracted joints gradually, the "twister" was devised by Mommsen. This consists of a double weight which is gradually shortened by the turning of a wooden spatula acting as a lever, by which means employment of force can be avoided. For the application of sudden and more powerful force several kinds of apparatus, from the simple wedge to complicated osteoclasts, have been invented. Supports and artificial parts require a full knowledge of mechanics and often provide difficult and more responsible problems than the construction of a machine for technical purposes. A good example is the making of a support for flat foot; for this, calculations must be made similar to those required by a

bricklayer, for example, on the firmness of material, and the alterations in the pressure of the resting and moving foot in standing, walking and running. It is only by the proper use of every physical principle that a suitable apparatus can be constructed for the cure of flat foot.

Orthopædic gymnastics we can look upon as an exalted form of employing manipulations. Here the hand of the *person treating* does not act on the body of the patient, but the patient is induced *through the mind* to make the necessary correction himself, and along with these static changes, the pleasure in movement is increased and confidence raised. In group gymnastics we also encourage a desire to imitate and to induce healthy rivalry. Thus, employing the medium of mechanics, we can attain, through the mind, a mechanical and physiological cure.

Heat.—The applications of light and heat are difficult to separate in physical therapy. We are inclined, however, to place in a category by itself that modern development of electricity, ultra-short wave therapy, since this represents, in our view, only pure heat. We must, however, also distinguish two main fields, viz., ultra-violet or photo-chemical rays, and the real electrical field, which includes galvanic or faradic currents. The principle of the heat effect is always the same. The heating is said to cause hyperæmia and through this to allay pain and inflammation and soften the tissues. The methods of application are innumerable. But the most elegant and complicated are by no means always the most curative.

While heat in the form of moist warm or hot poultices still plays an important part in general practice, other methods, such as the use of hot steam and hot air are in danger of being ousted by the newer methods such as ultra-short waves. This is not always justifiable, for in the treatment of contracted joints, shrinking of capsules, neuralgia, and immovable flat foot, the steam jet and the hot-air jet are still unsurpassed. Even the Gaurer heating in a hot chest, the full bath or steam bath are hardly surpassed by electrical hyperthermia. In arthritic troubles these often work wonders. Whether, however, a particular case requires damp heat (steam) or dry heat (incandescent lamps or hot air) must be decided on by the experienced specialist. Many authorities use electrical heat in muscle paralysis. I cannot convince myself of the utility of this method. Should circulatory disturbances occur in the extremities in poliomyelitis, accompanied by coldness and cyanosis of the parts, then unquestionably deep heating is decidedly of great value.

Ultra-Violet Irradiation.—So much has already been said in the *Journal* on ultra-violet irradiation that I cannot add anything essential to it. But I should like once more to stress that, in the prophylaxis of rickets, it is not so much a question of intensive irradiation as of *early* irradiation. From the first I have advocated that prophylaxis in rickets should begin at the second month of life, since at this period disturbances may occur which, later, no kind of treatment can cure. I remember very well that, even in Northern countries, and in winter, we carried on sufficient prophylactic treatment by means of direct daylight. In this way sufficient prophylaxis could be effected according to the principle that small doses are better than none. In strong sunlight we prefer the effect of sky-shine to the direct rays of the sun. This applies above all to the treatment of surgical tuberculosis in which to-day light treatment has almost completely ousted surgical procedures. In this, we seek to avoid the direct rays of the sun on account of the possibility of activating latent foci. We consider to-day that, without surgical interference and by means of well-directed light therapy, we can often attain the complete cure of tuberculosis of bones and joints.

Electricity.—We use actual electrical treatment in nerve paralysis, especially of the infantile form. We must, however, have a clear idea what we wish to attain by electrical treatment. The idea that we can restore a damaged neuron, and make it capable of conduction, by an electric current, is absolutely false. Once a neuron is

diseased or dead—due to the failure of the ganglion—no amount of electricity can revive it. This is also the case when the neuron is separated below the ganglion. What we can effect with electrotherapy is only to protect a muscle from atrophy till either the ganglion has recovered through absorption of the inflammatory exudate, or the severed ends of the neuron are reunited. Nothing more can be expected or effected by electrotherapy. Sometimes, however, an improvement takes place even after two years, and, if the revived nerve then acts upon a well-exercised muscle, the cure is complete. We employ the faradic current to excite the muscle directly and use the galvanic current to stimulate it through its nerve. The " tonizer " (tonisator) which produces physiological contractions of the muscle, does excellent service. The technique of the electrical treatment of nerves is very difficult, and presupposes, not only accurate anatomical knowledge, but great experience in the possibility of regeneration in the diseased area. To leave this work to the inexpert assistant, as is often done, is therefore useless.

X-rays and Radium.—Very recently it has been proposed to treat the parts of the spine afflicted with poliomyelitis by X-rays. In spite of the plentiful literature it is not clear whether the improvement really observed can be put down to this treatment. But, owing to the seriousness of the disease, no means, the safety of which is known, should be left untried. The same applies to the heating of the diseased spine by diathermy. Much treatment of tuberculous joints is to-day being carried out by X-rays, but in this case also it is not always certain whether the cures can be rightly ascribed to the effect of the X-rays.

Radium in the form of emanation is much used for arthritic diseases, especially for chronic polyarthritis which reacts well to this treatment. Solutions of radium emanation for drinking can be prepared with modern apparatus. Quite recently small quantities of oil have been irradiated, and in this form it is easily put up in capsules. Solutions of radium chloride are also available for injections.

We have given a short survey of the physical methods employed in orthopaedics. This is by no means exhaustive, but we hope that we have given some useful hints as to how physical methods may be used in this field. We should like, however, to warn against using too many methods and would recommend the use of a few, and these only in special cases; they should, however, be carried out thoroughly and persistently.

ACHIEVEMENT—*contd. from p. 123.*

has not been quite stationary during the last ter years.

And what part has this *Journal* played in such progress? Ceaselessly it has been expounding the doctrine of physical medicine to all who would listen. Its pages have been the battle-ground for many causes concerned with the welfare of our subject; they have recorded step by step the progress of physiotherapy, not only in this country, but throughout the world (to give only one example, this *Journal* was the first to explain the merits of short-wave therapy in Great Britain); and it has been the only ethical and independent British journal to devote itself exclusively to the science of physical medicine. In this work it has been fortunate in having had the support and co-operation of those specialists in every country best qualified to write on our subject.

For some time there has been evidence of a growing and wider appreciation of the value of physiotherapy both in institutional and private practice in this country, and those who have worked long and arduously for this will have the satisfaction of knowing that their work has not been in vain, and should be encouraged to go forward.

A NEW "DOSEMETER" FOR SHORT-WAVE THERAPY

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and

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IN writings on short-wave therapy it is customary to describe the intensity of the dosage given in one of two ways; namely, in terms of the sensations of heat felt by the patient, or by certain more general phrases such as " a powerful short-wave current " or " Low Intensity Technique " (L.I.T.). Yet it is quite easy to measure the currents reaching the electrodes with an accuracy comparable with that achieved in pharmacology by that homely unit of volume, the tablespoon. We prefer to measure, not the current reaching the electrodes, but the current leaving the front face of the " active " electrode for the adjacent part of the patient's skin. The strength of this current is, we feel, as good a single criterion of the intensity of a short-wave dose as one can well hope to obtain.

The object of this paper is to describe the " dosemeter " which we use for the rotating electrode and to give specifications of dosage for the treatment of sinusitis[1], [2] so that any clinician wishing to repeat this work can verify that he is, in fact, feeding to the regions concerned the same current strengths that we advise.

CONSTRUCTIONAL FEATURES

The dosemeter is shown in section and plan in Figs. 1 and 2. The " active " electrode, A, of cardioid, circular or other shape, is screwed into the shaft B, which may be maintained in slow rotation as described in previous papers[2], [3]. A recess is machined in the face of this electrode, and a hole is drilled through the centre of the recess. A lamp socket C, is silver-soldered into the hole, and carries at the back of the electrode a 2.5 volt lamp D. A thin disc E, with a diameter about 1mm. less than the diameter of the recess, is supported by the centre pin of the lamp socket, and is spaced from the back of the recess by the insulating washer F, so as to be flush with the front face of the electrode. The whole arrangement is mounted behind the usual Schliephake glass " shoe " (not shown), to prevent accidental contact with the patient.

ELECTRICAL FEATURES OF THE " DOSEMETER "

Current can reach the disc E from A in two ways: (1) through the lamp filament; (2) by capacity, in virtue of the proximity of E to A. Measurement of the resistance of the lamp, and its reactance at 6 metres, shows that its impedance is very much less than the impedance of the capacity between E and A (of the order of one-hundredth). So we can say that for practical purposes the current through the lamp—as indicated by its brilliance—is that part of the dose which leaves the front face of the disc E. The current which leaves the whole front face of the electrode for the adjacent region of the patient's skin will be obtained approximately by multiplying the current in the lamp by the total area of the electrode (including E) and dividing by the area of E. It should

be realized that some of the current leaving the back of the electrode, and even some of that leaving the electrode stem and leads, will, in general, pass through the patient. On the other hand, these portions of the current will be reaching regions of the patient which we are not trying to treat and so do not form part of what we wish to measure.

The current in the lamp is measured with the aid of a duplicate lamp, fed through

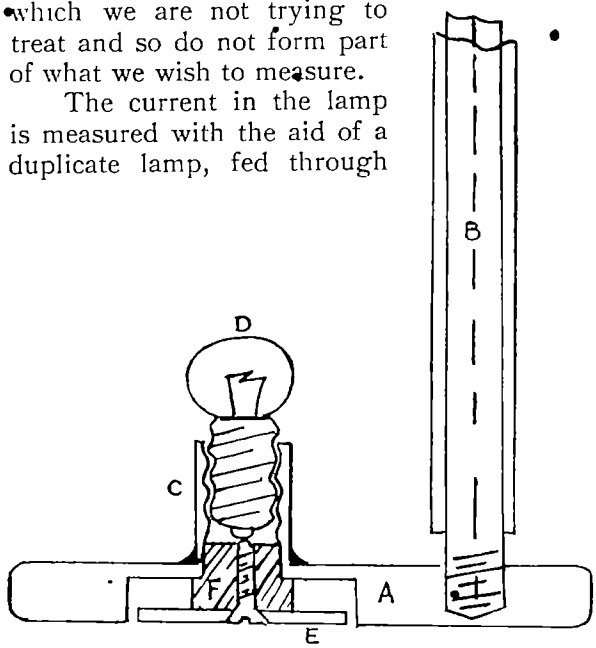


Fig. 1

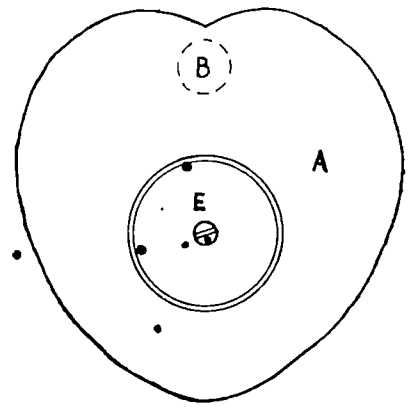


Fig. 2

a rheostat and a meter with D.C. (or 50 cycle A.C.), the two lamps being adjusted to equal brilliance. The brilliance of a lamp varies very much more rapidly than the current through it, especially in the region of "yellow heat" rather than "white heat," so that in this region it is easy to obtain current readings with the duplicate lamp, consistent to 5 per cent. The lamps used are of standard pattern, rated at 2.5 volts, 200 mA; we prefer to arrange that the comparison lamp is maintained at a "standard" brilliance of 150 mA, and to have a series of electrodes of varying size of the disc. This provides the degree of "yellow heat" at which we find the comparison easiest. If one is prepared to tolerate a dosage error of 10 per cent. in current—20 per cent. in power—it is hardly necessary to use the comparison lamp; one can simply memorize the standard "yellow heat" appearance. Such a practice would compare favourably with that of measuring a dose of medicine in a tablespoon where a 10 per cent. variation in the depth of the liquid means a 20 per cent. variation in the volume.

To cover the whole range of intensities likely to be met with in practice, a set of electrodes A is provided with discs E of different sizes. At present five are in use as follows:—

Electrode No.	Area of A. including E.	Diam. of E. cm.	Area of E. cm.²	Approx. "standard" dose in amps
1	14.1cm.(2)	—	14.1	0.15
2	,,	3.1	7.6	0.28
3	,,	2.5	4.9	0.43
4	,,	2.1	3.5	0.61
5	,,	1.8	2.5	0.83

In No. 1 electrode, the disc E, which was cardioid in shape, formed the whole front surface of the electrode. The column "approximate standard dose" has been formed simply by multiplying the "standard" lamp current by the ratio of areas, A/E. No "skin effect" correction has been applied to the D.C. current measured

in the comparison lamp, as the correction in question (which varies with resistivity and hence with lamp brilliance) is only of the order of 2 per cent. for these lamps at 6 metres.

CLINICAL FEATURES

As would be expected, it is found that changes in the air gap between the electrode and the patient's skin can cause a considerable change in the lamp brilliance—i.e., in the current actually reaching the patient's skin—without corresponding changes, or even with an opposite change, in the current in the coupling coil, in the patient's circuit. It is further found that the patient's sensations of heat correlate closely with change of lamp brilliance. (The sensation of heat is, however, dulled towards the end of a long dose).

Patients can see the reflection of the lamp in the glass " shoe " of the electrode, and the more intelligent find it easy so to orient and place their heads (during a nasal treatment) that the lamp brilliance remains almost uniform throughout the cycle of rotation of the electrode. This completely supersedes the neon light which was suggested in the paper on asthma.

The importance of measuring the current in the " active " electrode, when the patient is not symmetrically placed between the electrodes, is well illustrated by the following experiment.

Two of the electrodes in the series, Nos. 1 and 3, were fitted to a 6-metre therapy unit, and placed about 5 inches apart. The valve-filament voltage was increased until, when resonance was established, the lamp of No. 1 electrode (i.e., the more sensitive) lit to the " standard " 150 mA brilliance. The lamp of No. 3 (the less sensitive) did not light, as indeed was to be expected. If a hand was now placed over the glass " shoe " of No. 3 electrode, and resonance was restored, the lamp on No. 3 electrode lit brightly; the lamp on No. 1 did not light. The sensation of heat in the hand was confined to the surface opposite the lamp which was lit.

USE OF THE " DOSEMETER " IN PRACTICE

In practice we have found that the five standard doses provided by the five electrodes serve to cover the range of intensities we employ. We do not see how it is possible to describe the 5 doses precisely by the phrases in use in current literature. We may, however, observe that most patients are not conscious of any sensation of heat when a " standard " dose with No. 1 electrode is given. This dose (approximately 150 mA) would presumably be termed " athermic." Proceeding to the opposite extreme, we can say that a " standard " dose with No. 5 merits the phrase of respect—" powerful short-wave current," for, if it is given to patients who have not already had a " course " of treatment with progressively increased doses, they generally complain that it it excessive; we have, moreover, ourselves experienced slight giddiness from a sudden application of this dose (not during a " course ").

We can give precise descriptions of the use of the new meter only in terms of our own practice, and will do so by comparing the specifications for dosage which were given in the description of nasal therapy in asthma.[3]

Assuming that electrode sizes and positions have been accurately followed, the commencing dose in a chronic case would be 10 minutes of treatment with No. 2 electrode with that intensity which will light the lamp to the " standard " 150 mA brilliance (approximately 0.28 amp). If no reaction follows this dose the second treatment is given with the No. 3 electrode, and for 15 minutes (approximately 0.43 amp). The third treatment lasts 20 minutes with No. 4 electrode (approximately 0.61 amp), and in the average case, the remaining nine treatments would be given for 20 minutes each with No. 5 electrode (approximately 0.83 amp).

Continued on p. 133

DIATHERMY IN DENTISTRY

BY SARA GARBARSKA-SARCINA, D.M.D. (Berlin)

THE preservation of the teeth and its influence upon general health are problems which have engaged the attention of dentists from the beginning of their science, and one which will always provide a stimulus for further research. A great deal has already been achieved in this field; thus it is possible to preserve the pulp by the early treatment of caries. In all cases in which it is not possible to preserve a healthy pulp, however, thorough treatment of the diseased part is most important for the preservation of the tooth.

Many methods of root treatment have already been tried and examined as to their efficiency. The most important among these appears to be the application of different medicaments, a procedure which has proved to be unsatisfactory, since foci of leucocytes and tissue necrosis due to the treatment have been observed in the apical region. Extirpation of the pulp under local anæsthesia has also not achieved the desired result.

A new stimulus has been given to root treatment by the introduction into dentistry of diathermy. Both forms of diathermy application, medical and surgical, are employed in dentistry. The medical type is used for post-operative pain and for all inflammatory processes of the jaw, these having been previously treated with radiant heat. Recently short-wave application, either alone or in combination with diathermy, has been employed for the same purpose.

The more important application of diathermy, however, is in the practice of dental surgery. Here diathermy is largely utilized for the purpose of killing living pulp-tissue, and for destroying the existing bacteria. This " devitalization " is carried out with apparatus similar to that used in medical diathermy. The electrodes are, however, different: a Miller needle, the shape of which corresponds to the anatomical form of the root canal, is used as an active electrode. This needle is fitted to a glass holder, which is surrounded by an interchangeable and well-insulated handle. The electrode is of a handy size and can easily be sterilized. The inactive electrode is a steel cylinder which the patient holds in his hand.

The cross section of the active electrode is very small, especially at the point, the density of the current there being especially great. The current leaving the point of the active electrode tends to spread, but is prevented from doing so by the hard tissues of the tooth which are bad conductors. The current finds much less resistance in the strongly vascularized pulp. This passing of the current through the pulp tissue leads to its destruction. The greatest density of the current occurs in the narrowest part of the canal, i.e., mostly at the apical foramen. On leaving this narrow foramen the current spreads, since there are no longer insulating dentine walls, and therefore the intensity of the current decreases. The paradontal tissue may become affected, but greater damage cannot be expected. In this manner the " devitalization " of a pulp as far as its finest branches can be obtained, if the technique be accurately applied. The extent of the changes can be controlled in each case.

The changes taking place in the pulp tissue under the influence of diathermy are quite different from those occurring under the influence of chemical substances. For instance, when applying arsenic, the changes begin with hyperæmia of the blood

vessels, followed by blood stasis and, finally, by a coagulation thrombosis. Hæmorrhages, due to bursting of the blood vessels, occur; there is degeneration of the pulp nerves and tissue, amongst which the odontoblasts and other pulp cells suffer, leading to loss of their staining reactions. Longer action of the arsenic causes complete necrosis of the pulp tissue. Unpleasant after-effects are, therefore, frequently inevitable, due to partial absorption of the arsenic itself. On the other hand, diathermy causes a coagulation of the whole tissue proteins, by heating of the pulp. Therefore, after-effects cannot occur.

HISTOLOGICAL EXAMINATION OF THE PULP AFTER APPLYING DIATHERMY



Fig. 1.

(a) The pulp as far as the apical foramen is structureless; (b) minimal infiltrated periodontal tissue near the foramen; (c) blood vessels.



Fig. 2.

(a) Intensive action of diathermy; (b) less strongly affected pulp; (c) odontoblasts near the side of the canal wall.

In Fig. 1 is shown a pulp which was devitalized by diathermy. It will be seen that the tissue as far as the apical foramen is structureless. A limited region of the periapical tissue near the foramen is somewhat infiltrated. The periodontal tissue is rich in blood vessels.

Fig. 2 shows a section of the middle part of a treated tooth. The degree of coagulation is different in various parts of the pulp as a consequence of a jerk-like movement of the electrode needle. In those sections of the pulp marked *a* and *b* in the photograph, the action of the heat was so intensive that the nuclei of the pulp cells were completely dissolved. The tissue between these two parts was not so strongly affected by the jerk-like movement of the needle and shows, therefore, its original structure; this is particularly apparent near the side of the canal wall (*c* in photograph). This case indicates the effect of diathermy when an unsatisfactory technique is employed.

This method of pulp devitalization favours the preservation of the tooth and gives it a certain protection against the formation of granulomas and cysts at the root apex, which are frequently the cause of various systemic disorders. The action of diathermy naturally also sterilizes the root canal, or at least it inhibits the action of bacteria so that they are harmless. This is achieved by the property of the current passing through the finest branches of the root canal and the extremely fine dentical tubules.

Further treatment, e.g., amputation or extirpation of the devitalized pulp, has to be performed under aseptic conditions in order to maintain the existing state of the root canal. This treatment is no longer concerned with cure but with preventing the formation of apical foci (focal infection), which are frequently the cause of rheumatic, arthritic and other general diseases.

X-RAY EXAMINATION AFTER ROOT TREATMENT BY APPLYING DIATHERMY.



Fig. 3.



Fig. 4.



Fig. 5



Fig. 6.

Fig. 3.—*Pulp devitalized by diathermy; root filling.*
Fig. 4.—*Examination after* 13 *months.*
Fig. 5.—*Pulp devitalized by diathermy, amputation.*
Fig. 6.—*Examination two years later.*

X-RAY EXAMINATION AFTER TREATMENT OF GANGRENE OF THE TOOTH CANAL.

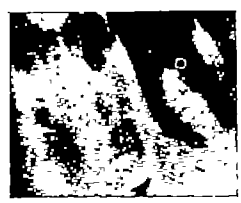


Fig. 7.



Fig. 8.

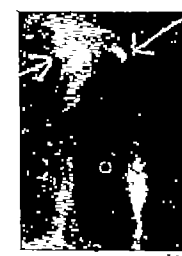


Fig. 9.



Fig 10.

Fig. 7.—*Gangrene treated by diathermy; root filling.*
Fig. 8.—*Examination one year later.*
Fig. 9.—*Gangrene treated by diathermy; root filling.*
Fig. 10.—*Examination two years later.*

The two pairs of X-ray photographs, Figs. 3-4 and 5-6, show the results obtained 1-2 years respectively after devitalization of the pulp by diathermy followed by subsequent filling of the root canal. The pictures show neither apical foci nor any abnormal changes.

The application of diathermy is, however, still more important in the treatment of an already existing focal infection. Frequently in dead but infected teeth, foci are formed near the root apex. They tend to liberate toxins and micro-organisms into the blood stream, thereby causing the formation of further foci in other parts of the body. The primary foci originate, in most cases, from the decomposed pulp tissue, and therefore the application of surgical diathermy is of the utmost importance in such cases. The action of the high-frequency current is thus not restricted to the production of heat in the root canal and the destruction of bacteria. It also influences significantly the effect of medicaments applied at the same time, i.e., chloramine and hypochlorites, the effects of which are increased by about 20 times when the temperature is raised by 20° to 50°F. It is known that the disinfectant reactions of these medicaments are

due, not so much to the development of chlorine, as to the liberation of active oxygen. Being in the nascent state, the oxygen is capable of destroying existing bacteria, or, at least, of considerably inhibiting them. This action extends as far as the apical foci, leading to their resolution. X-ray photographs (Figs. 7-8 and 9-10) taken after 1½-2 years show that the original rarefied areas at the apex have completely disappeared and that the normal bone structure is re-established. It is to be noted that the treatment of focal infection performed in this manner frequently leads to the cure of an existing acute rheumatic condition.

It remains to say that surgical diathermy is also of great importance in the treatment of other oral diseases. The same type of electrode is employed, differing only in so far as the Miller needle takes the form of a sling. The method may render excellent service for the removal of gum-tags in cases of difficult perforation of a wisdom tooth, various kinds of over-growths and gum-pockets in paradontal disease.

A NEW "DOSEMETER" FOR SHORT-WAVE THERAPY—*contd. from p. 129*

The treatment of head colds demands careful dosage to obtain the results described[3]. In a given case, the dose depends largely upon the severity of the cold and the length of time it has been present when the patient presents himself for treatment.

In general the dosage is as follows :

(1) During the first twenty-four to forty-eight hours, seven to ten minutes' treatment are given with No. 2 electrode (approximately 0.28 amp). One treatment should be sufficient but, if another treatment is necessary, the same dose is repeated on the following day.

(2) If the cold has been present from two to four days when the patient is first seen, two or three treatments are usually necessary. These are given daily as follows :

First treatment,	10 minutes	with	No. 2 electrode	(0.28 amp).
Second ,,	10 ,,	,,	No. 3 ,,	(0.43 ,,).
Third ,,	15 ,,	,,	No. 3 ,,	(0.61 ,,).

Some clinicians might find that, with the electrode system we advise, the lamp cannot be lit with No. 5 electrode. This would indicate that the set is failing to put sufficient power into the electrode arrangement, and the results described cannot be expected to follow. The absence of an adequate output from a set cannot be compensated for by increasing the time of administration. A short-wave dose is not to be regarded as the product of its intensity and the duration for which it is given. It should, further, be pointed out that the doses we have described apply to a rotating electrode. Few, if any, patients would tolerate No. 5 electrode unless it were kept in continual rotation.

Our thanks are due to Miss H. Holmes for her help in the calibration of the " dosemeter " and her suggestions, which have led to many of the dosage specifications described.

The " dosemeter " in its present form may be obtained from Metropolitan-Vickers Electrical Company, Trafford Park, Manchester.

REFERENCES.

(1) STOCK, J. P. P., and BURCH, C. R. *Brit. Journ. Phys. Med.*, 1938, Vol. 1, New Series, p. 406.

(2) STOCK, J. P. P., *ibid*, 1939, February, p. 32.

(3) STOCK, J P P., *ibid*, 1938, June, p 196

A NEW METHOD OF SHORT-WAVE TREATMENT OF THE LOWER EXTREMITIES

By VICTOR TOMBERG, Ph.E.
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SUCCESSFUL application of the technique of short-wave treatment is based upon mastering various factors. Next to the question of duration of treatment, the wave-length and the intensity of the field, that of the most adequate electrode disposition is of fundamental importance.

The deep-seated action of the condenser field, as enunciated by Schliephake and others, depends on different factors. This applies especially to the distance of the electrodes from the body and to their area. If the electrodes are quite close to the body, the deep action is at a minimum and no more than when using ordinary diathermy with the ordinary uncovered metal electrodes. This means that skin and fatty tissues are most strongly heated, and actually 3 to 5 times as much as muscle (or the deep-seated medium). The further the same electrodes are removed from the surface of the body, the less the skin and fatty tissues (as regards depth) are heated, and one can finally manage to heat at a depth as strongly or even more strongly than the skin. One can obtain this effect in certain cases—depending on the size of the object and its physical constants—by enlarging the area of the electrodes, while maintaining a constant but small distance of the electrodes from the body. This means that large electrodes have a greater depth effect than small electrodes at the same distance from the body. The physician, therefore, has a convenient choice between the size of the electrodes and their distance from the body when he desires to heat the deeper parts of the body more or less markedly than the surface. If, for example, he wishes to treat a furuncle of the face, the deep effect must be little, since one does not wish to treat the brain at the same time. In this case we require small electrodes and a small distance. If on the other hand we wish to treat a pulmonary abscess, the deep-seated effect must be made as great as possible, since it is desirable to exclude a superfluous heating of the skin. In this case there should be large electrodes with a greater distance from the body (over 5 cm.).

The question of longitudinal heating of limbs is of vital importance, since a great many patients, in whom short-wave treatment is indicated, suffer from vascular and nervous diseases affecting the limbs. It is quite obvious, therefore, that, for the treatment of such diseases, longitudinal heating of the whole limb is preferable to the transverse heating of one or more limbs.

At present, longitudinal heating is carried out by the following methods:

(1) The electrodes are adjusted at the ends of the extremity, i.e. above the sacrum and to the sole of the foot. This method fully corresponds with the electrode arrangement used in transverse heating: the condenser field is extremely protracted, i.e. the lines of force of the field are markedly drawn out lengthwise, traversing the whole extremity.

(2) A metal band several metres long, covered with a thick layer of india-rubber is wound round the extremity (coil-field of Kovarschik) and both ends of the band are joined to the generator.

(3) Two metal rings covered with india-rubber are applied to the ends of the extremities (ring-field of Schäfer).

In spite of the different external shape of the electrodes the fields are extremely similar. In the first method—the condenser field—lines run in a direction longitudinal

to the leg. But the coil field of the short-wave current, also, is in fact nothing but a varied condenser field.* For, as investigations have shown, the short-wave current does not travel through the turns of the coil alone but leaps from turn to turn and penetrates the object capacitatively. Therefore, the coil may be severed at any point whatever and may even be replaced by a system of rings. It is essential that, in the short-wave coil-field, the lines of force penetrate the limb longitudinally. The ring-field, which may be considered as a special arrangement by Kowarschik, likewise shows electric field-lines running from ring to ring parallel to the extremities.

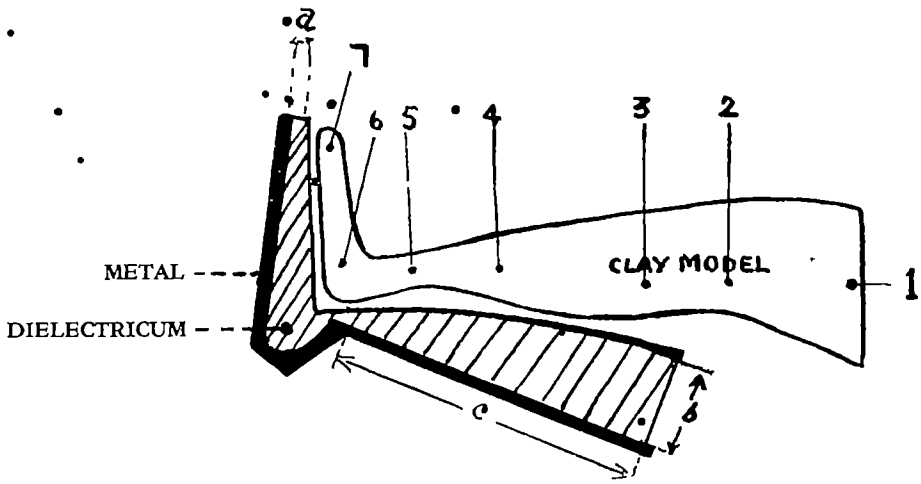


Fig. 1.—Sketch of the Temperature-Measuring Spots on the Clay-Model and arrangement of the New Wedge-Electrode.

But the distribution of heat in the extremities, when using the above-mentioned method, is of a different kind. We see that, in using the first method, the maximal heating appears in the narrowest cross-section, i.e. in the region above the ankle-joint. In using the ring-field or coil according to experiments with the phantom, the central parts (knee-joint) show the greatest heating. This dissimilarity of heating is naturally not intended. Taking the point of view that there is an optimal dosage for the treatment of vascular and nervous diseases, the most homogeneous field possible naturally seems worth attaining. Obviously the difficulty lies in the fact that the leg is unequal in cross-section at different levels thus leading to a crowding of field-lines in the narrower parts and consequently to an irregularity of the field. Leaving the foot out of consideration for the moment, the lower extremity is roughly the shape of a truncated cone with a large proximal and a very small distal plane. The problem is how to find a disposition guaranteeing a homogeneous thorough heating of an obtuse cone.

The following investigations were carried out jointly with H. Weisz, assistant at the Poliklinik, Vienna, in the ward of Professor A. Strasser, with the object of finding out the forms of electrode most suitable for practical purposes. The intensity of the field is measured by the amount of heat produced, whether we consider the efficiency of short-waves to be due solely to a heating effect or otherwise. Thorough heating with various forms of electrode was carried out on a clay-phantom, in the shape of the lower extremity, and alterations of temperature were measured.

* The last investigations of the author have shown that the coil-field also has another effect depending on the resonance-tuning.

The experiments were partly performed with the help of a valve generator (v.g.) with a wave-length of 6 m. partly with a spark-gap generator (s.g.) with a wave-length of about 10 m.

The length of the phantom was 95 c.m.; the d ameter at the thicker end was 18 cm., and the diameter at the narrowest part above the ankle-joint, 7 cm. The places marked with the figures 1—7 signify the points where the temperatures were taken.

A novel form of electrode, previously invented by H. Weisz and the author, was tested. In Table 1 the values (reduced temperature-degrees) acquired with the

TABLE 1.

Distribution of Heat in the Clay-model when Using Wedge-electrodes of Various Forms.

No of Experiment.	Length of the shank extension. c	Distance from Surface. a	Distance from Surface. b	Rise in Temperature. Arbitrary Units at Measuring Spots 1	2	3	4	5	6	7
1	0	9 mm.	0 mm.	1	8	8	19	31	20	8
2	half shank	9 ,,	9 ,,	4	7	18	22	15	4	1
3	whole shank	9 ,,	9 ,,	8	11	18	5	3	0	1
4	whole shank + ⅓ upper thigh	9 ,,	9 ,,	13	19	10	2	0	0	2
5	half shank	5 ,,	30 ,,	5	5	12	9	7	2	4
6	whole shank	5 ,,	30 ,,	8	9	20	9	6	4	4
7	whole shank + ⅓ upper thigh	5 ,,	30 ,,	10	16	10	6	2	3	4
8	half shank	5 ,,	58 ,,	9	9	11	8	8	4	7
9	whole shank	5 ,,	68 ,,	9	9	11	8	8	4	7
10	shank and + ⅓ upper thigh	5 ,,	68 ,,	14	16	12	8	7	4	4

TABLE 2.

Comparison of the achievements of the valve apparatus and spark-gap apparatus in distance-treatment and by the help of wedge-electrodes. Rise of temperature in arbitrary units.

Measuring Spots		1	2	3	4	5	6	7
Spark-gap Generator (s.g.)	wedge-electrode	9	9	11	8	8	4	7
	distance-treatment	7	6	4	4	8	6	3
Valve Generator (v g)	wedge-electrode	30	27	30	32	38	16	14
	distance-treatment	48	30	25	20	25	17	10

TABLE 3.

Comparison of heat distribution (rise of temperature in arbitrary units) in methods used until now contrasted with the newly-developed method of Weisz & Tomberg.

Measuring Spots	1	2	3	4	5	6	7
Long-waves, two plates	3	5	10	14	20	24	5
Long-waves, three plates	18	20	10	13	45	42	3
v.g., foot and pelvis electrodes at the same distance	10	6	10	11	34	36	9
s.g., foot and pelvis electrodes at the same distance	15	10	10	23	37	24	10
v.g., suitable distance of the foot-electrode ..	19	12	10	8	10	7	4
s.g , suitable distance of the foot-electrode ..	17	15	10	10	20	15	7
v.g., suitable wedge-electrode	9	8	10	11	13	12	8
s g., suitable wedge-electrode	8	8	10	7	7	4	6

aid of the spark-gap generator are noted. The duration of the heating lasted for 15 minutes, and the wave-length fluctuated in the various experiments round about 10 m. In all the experiments there was an electrode opposite the thicker end, separated from the model by a rubber layer 0.5 cm. in thickness. A sole-plate which gradually increased in thickness from the toes to the heel with a tapering continuation along the shank served as second electrode. In the corresponding columns the thickness of the dielectric at the thinnest part under the toes (a) and the other end of the electrode extension (b) are stated. In the last column of the table is given the length of the lengthening-piece of the electrode (c).

From the table the following conclusions may be drawn. The employment of two plates at both ends of the leg at approximately equal distances leads to an extreme degree of heating at the narrowest spot above the ankle-joint (1st horizontal line of Table 1). If the thickness of the intermediate layer does not increase towards the free end of the lengthening-piece a considerable degree of heating occurs (line 2—4 of Table 1). Therefore the wedge shape of the intermediate layer is necessary. The most uniform heating is attained when the lengthening-piece reaches as far as the knee-joint and is put there at corresponding distance (line 9 of Table 1). By lengthening or shortening the lengthening-piece one can regulate the shifting of the maximum of heating to the proximal or to the distal plane.

The question as to which of the two methods is the better one, i.e. which results may be obtained from the apparatus adjusted for resonance, is of great interest. From Table 2 we may gather that, when using a valve-generator (v.g.), there is no essential difference between the two methods. With the spark-gap generator (s.g.), on the contrary, the use of wedge-electrodes seems to be more favourable.

The improvement of the technique of treatment may be best explained by once again comparing the distribution of heat with the methods of treatment chiefly employed until now (Table 3). For completeness also the values are noted which have been obtained when using long-wave diathermy of the leg according to the two-plate method (one plate at the end of the pelvis the other at the sole) and according to the three-plate method (electrodes at the end of the pelvis, at the upper thigh and the sole). In order to make the results more comparable all the values are reduced to the same rise of temperature in the region of the knee-joint. The Table shows with particular accuracy to what an extent the irregularities in the distribution of the short-wave energy may be abolished.

The dispositions found with the clay-phantom may be translated for the human leg without too great a margin of error. The fact, of course, must not be disregarded that, contrary to the homogeneous model, the leg is composed of a number of tissues acting in different ways as to their conductivity and dielectric constant and, therefore, they are heated in different ways in the short-wave field. On the other hand, the constantly circulating stream of blood combats localized super-heating, and thus the above-mentioned complication is mostly obviated. Self-experiments with greater distance of the foot-electrode, and with the wedge-electrodes, have shown that the arrangement described above is serviceable. Instead of a disagreeable super-heating effect of the distal segment of the shank, an *agreeable,* uniform feeling of warmth ensues.

Further experiments showed that these new electrodes are made therapeutically more effective by means of a special additional adaptation of the short-wave valve-generator; thus, better absorption of energy is made possible, i.e. treatment can be effectively given with smaller apparatus (and a lower output is necessary, say 200 watts). The short-wave apparatus constructed in the Tomberg Laboratories of Vienna, are made in accordance with the above circumstances and have, according to clinical expert opinion, given the best results in the treatment of the extremities (Groag, Appenzeller *et al.*).

Contd. on p. 146

SHORT AND ULTRA-SHORT WAVE THERAPY

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Continuing the Series of Papers on

ELECTRO-MEDICAL APPARATUS : ITS CHARACTER, OPERATION AND CARE : PART II. No. 9

THE wave-length ranges corresponding to the short and ultra-short bands have no accurately specified limits, but they are generally regarded as of the order of 10 to 30 metres for the former and 3 to 10 metres for the latter. The corresponding frequency ranges (cycles per second) are 30,000,000 to 10,000,000 and 100,000,000 to 30,000,000 respectively.

The remarks in the following paragraphs apply to the combined range except where definite reference is made to ultra-short.

In previous sections of this series we have seen that, in the case of surgical uses of high-frequency and of medical applications in the medium wave-length range, the current is applied to the patient with the electrodes in contact with the skin.

In short-wave work the patient, or the region requiring treatment, is placed in

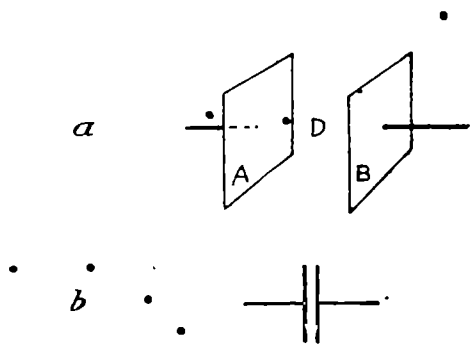


Fig. 141.

(a) Electrical condenser, A and B the plates, D the dielectric; (b) Symbolic representation of condenser used in circuit diagrams.

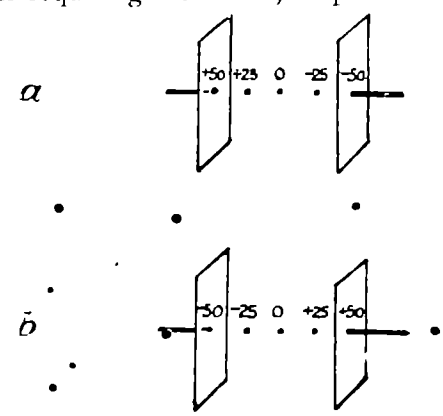


Fig. 142.

Diagrams showing the distribution of potential in a uniform field between two condenser plates across which a potential difference of 100 volts is applied.

the electric field between the plates of a condenser. The reader will recall that a condenser is composed of two conducting plates separated by an insulating medium called the dielectric (Fig. 141). Now, if a battery or other source of electromotive force be connected across the plates of the condenser, there will not be a free movement of electrons from the negative plate to the positive plate as there would be if D were a conducting medium. Instead, the condenser will receive a momentary charging current, the dielectric will assume a state of stress and an electric field will be present between the plates. If the dielectric is uniform there will be, except for edge effects, a uniform distribution of potential difference through the dielectric. For example, with potentials corresponding to + 50 and − 50 volts on the plates, the distribution would be as shown in Fig. 142a. When the potential difference across the plates is reversed the

conditions are altered as shown in Fig. 142b. Now, if instead of the steady E.M.F., an alternating E.M.F. were to be applied to the plates of the condenser, the conditions existing in the dielectric would be continually changing from those shown in Fig. 142a to those shown in Fig. 142b. The charging current would, of course, also be changing in direction and magnitude.

As shown previously,* the charging current in a condenser (or capacitative) circuit is not in phase with the applied E.M.F., but is 90° ahead of it. Since, however, a dielectric is not a perfect insulator there is a small loss current passing through it which is in phase with the E.M.F., and this current produces heating in the dielectric.

A number of condensers may be connected in series as shown in Fig. 143 and, if an E.M.F. be applied across the outer plates, then the potential difference corresponding to this E.M.F. is distributed between the condensers, the constituent potential differences across the several condensers depending upon the† capacitance value of each. In Fig. 143 the condenser symbols are of varying size to suggest

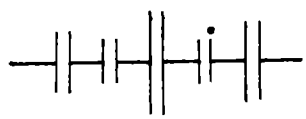


Fig. 143.
Arrangement of a number of condensers in series.

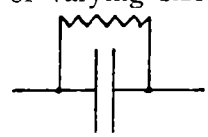


Fig. 144.
Arrangement of a condenser and resistance in parallel.

various values of capacitance. The capacitance value which determines the charging current for a particular value of E.M.F. does not only depend upon physical dimensions of the condenser, but also upon the dielectric constant of the material comprising its dielectric. It is not necessary to enter into the theory of the matter here, but it should be noted that, when condensers are arranged in series in this manner, the greater constituent potential differences occur across the smaller capacitances and the lesser across the larger capacitances.

THE HUMAN BODY AS A SYSTEM OF CONDENSERS AND RESISTANCES

In introducing into the field of a condenser any part of the human body we place between the condenser plates an elaborate system of condensers and resistances connected in series and parallel. This will be readily appreciated when it is recalled that human tissue consists of cells, and that each cell comprises protoplasm and an enclosing membrane. The protoplasmic fluid behaves as an electrical conductor and the cell membrane as a dielectric, so in each cell we have the components of a minute condenser. The adjacent conducting fluids provide the parallel connected resistances. Fig. 144 is a diagrammatic representation of a condenser with a resistance connected in parallel with it.

The fluids which contain ions or carriers of electricity are electrolytic, and their conductivity is associated with the mechanism of ionization and depends on the number of free ions present. When under the influence of an electric field, these positively and negatively charged ions are set in motion as follows. Ions which carry a positive charge are called cations and travel with the current, while ions which carry a negative charge are called anions and travel against the current. A reason why blood and muscle is generally of higher conductivity than fatty and bony portions of the body is that the former have a higher ionic content.

A large number of condensers connected in series and parallel may be represented as one " equivalent condenser ", and thus Fig. 145 gives a simple diagram which

*B.J.P.M., 1938, Vol. 1 (New Series), page 388, November.
†B.J.P.M., 1937, Vol. 12, page 98, September.

might be employed to represent the electrical circuit existing when part of the body is placed between the electrodes of a short-wave machine in operation.

In the application of short waves to the body a sequence of current pulses, rapidly changing in direction and magnitude, are passed to the patient. Since condensers are present in the human system, the charging current to them is also rapidly changing. Also the resistance components of the human system provide part of the current path. Thus the following are components of the total patient-current.

(1) The charging current for the condensers present in the organic substances. This current is flowing in the electrolytic fluids within the cell membrane and between cell and cell. It is ahead, in phase, of components (2) and (3) by 90°.

(2) The loss current in the membrane itself. This is a dielectric current.

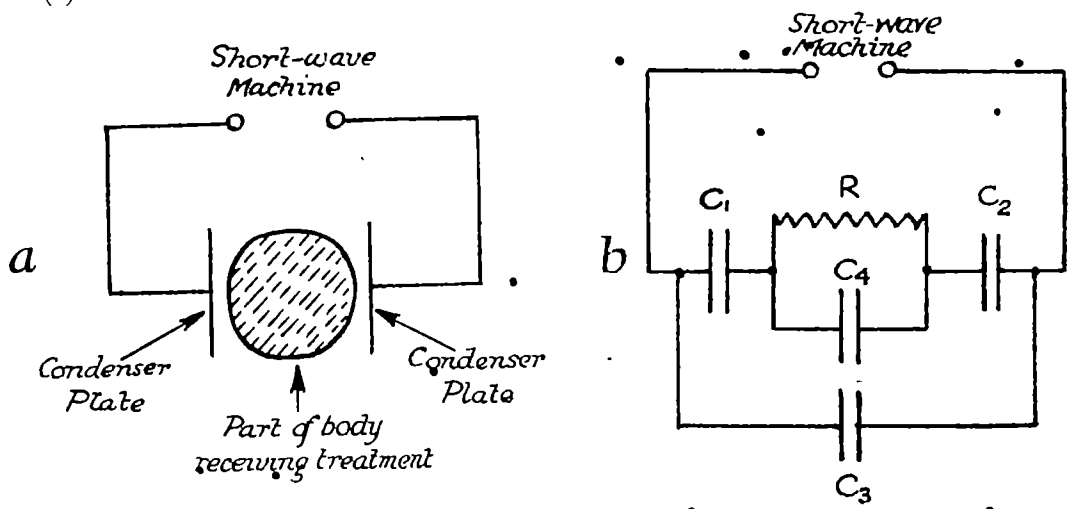


Fig. 145.—(a) Schematic diagram of short-wave machine applied to the body; (b) Equivalent electrical circuit of (a). C_1 and C_2 represent respectively the air condensers formed by one plate electrode and patient's tissue. C_3, the condenser formed by the two electrode plates and the intervening air. C_4, the equivalent condenser formed by the patient's tissue. R, the resistance of the patient's tissue.

(3) The current flowing in the fluid surrounding the cells. This current is in phase with the dielectric loss current (2). The fluid offers a resistance path in parallel with the cell condensers.

Now, at the very high frequencies corresponding to short-wave work, the difference between a conductor and a dielectric is slight and a change in frequency from a lower value to a higher one may make components of the human system to behave as condensers, whereas they were previously behaving as conductors.

The change of the manner of current flow and the position of current path due to change in frequency results in different physical effects and, while it can be said that there appear to be no " magic " wave-lengths, the different and changing constants of the matter in the path of the current give rise to selective heating. In other words, heating effects are produced in certain organs at one particular frequency which may not be produced at another frequency. The rise of temperature is a function of many additional factors due to the varying chemical composition of the substances in the human body. These factors include the resistivity of the conducting fluids, the dielectric constant of the dielectric materials, the weight of the organs in the path of the current, and their† specific heat. Electrode shape and position have a further effect upon electric field distribution and consequent heating.

†The specific heat of a substance is the amount of heat required to raise the temperature of unit mass (one gramme) of the substance through one degree Centigrade

With reference to the high-frequency generator, the output depends partially upon the size of the electrodes but, since the shape and disposition of the different parts of the body vary so much, it is impossible to predict how the current will flow in the patient and what will be the temperature rise of the body, even though machine and electrode characteristics are known.

It is apparent that high-frequency short-wave technique can produce local heating in the body. The heating may be dispersed by general conduction and by the flow of the blood stream, and it is difficult to arrive at any accurate idea of local temperatures from the use of a thermometer applied to the mouth or to some external point. This means that short waves should be employed with considerable caution, the reactions of the patient being carefully observed during the application of the current.

It is not yet known whether high-frequency short-wave currents have any effects other than those resulting from heating. There is an influential body of opinion supporting the view that there are other effects and an equally influential body of opinion opposing this view. It is clear that a good deal of research is still required on this important subject and that apparatus adaptable to experimental work is necessary for laboratory investigation as distinct from routine treatment.

Electrodes for Short-Wave Work

Electrodes for short-wave work may be plain metal plates between which the patient is placed and from which he is separated by air spaces. The commoner practice is to use electrode plates covered with rubber, ebonite or glass. Two large ebonite-covered metal plates may, for example, be arranged vertically at the sides of a long horizontal couch upon which the patient may recline. The metal plates are connected to the output terminals of the short-wave machine and an electric field is set up between them when the machine is put into operation. Thus large regions of the patient's body may be subjected to the condenser field.

Circular or rectangular metal plates enclosed in rubber or glass are designed in suitable sizes for application to the head and limbs. These electrodes supported on arms carrying the leads from the short-wave machine may be strapped or clamped in contact with the patient at the required point, the insulating covering of the electrode metal providing distance pieces between the metal and the patient's skin.

It will be appreciated that, in general, the nearer the condenser plates are to the patient, the greater is the capacity of the patient circuit and the higher the charging current. Methods of adjusting the patient current, tuning, etc., have been considered in an earlier article.

(To be continued.)

Electrotherapy in Mental Disease

E. A. Elliott (*Med. Jour. Austral.*, 1939, xxvi, 180) has treated by means of electrotherapy 23 patients suffering from mental states of a psychoneurotic or psychiatric nature, including schizophrenia, neurasthenia and hypochondria. All the patients recovered. Treatment was given for 20 minutes, three or four times a week. The first change noticed was a soothing effect, the patients not uncommonly falling asleep during the treatment. The inductotherm was employed. A case of post-encephalitic Parkinsonism is recorded, in which great improvement followed 130 treatments during a period of eight months.

SMEDLEY'S HYDRO, MATLOCK

Dr. Geoffrey Holmes has been appointed Consulting Physician to Smedley's Hydro, Matlock, Derbyshire.

Owing to pressure on space in this issue, it has been necessary to hold over the "Reviews of Books" Section, but this will appear in the June issue and will include reviews of several interesting publications.

THE WORLD'S NEWS AND VIEWS ON PHYSICAL MEDICINE

INTERNATIONAL REVIEW

THE PHYSIOTHERAPY DEPARTMENT OF THE NEW WESTMINSTER HOSPITAL

The Westminster Hospital is to be congratulated on its fine new Physiotherapy Department, the establishing of which has been rendered possible by the foresight and co-operation of the Secretary, the Matron and Mr. Rock Carling, the senior surgeon. This new Department should prove a shining example to other hospital authorities who are planning reconstruction.

That part of the new building allocated to the Physiotherapy Department is rationally placed, and forms a link with the X-ray and Radium Department on the one hand and the Orthopædic Department on the other. One of the most interesting innovations is that massage and remedial exercises are no longer divorced from light and electrotherapy.

Moreover, far from being a dark and dingy corner situated in the basement, as is so often its location in hospitals generally, it is a large, airy, spacious and well-lighted department. The lay-out provides for supervision of the whole department by anyone standing in the centre of it. One, or at the most, two members of



[*By courtesy of "The Times."*

The Great Hall of the Physiotherapy Department of the new Westminster Hospital, in which can be seen some of the various types of Electrotherapeutic Equipment.

the staff can have every patient under observation.

There is a large gymnasium where massage and remedial exercises are given. Leading off from this is a section for medical electricity and infra-red irradiation. To the right is that part allocated to short-wave therapy. Further back are baths for hydrotherapy, while the opposite end of the department, cut off by means of plate-glass screens, is arranged for ultra-violet irradiation, both local and general.

As regards apparatus, the Westminster is probably the only Hospital which can state that the whole of its equipment is of British manufacture, a noteworthy point at this important period in the history of our country. The apparatus has been carefully selected by the Physician-in-Charge, who has assured the Hospital authorities from personal experience that British-made goods are equal in every respect to any apparatus made abroad. Again, electrical details all conform to the various recommendations both of the Ministry of Health and of the Institute of Electrical Engineers, where such recommendations are applicable to electrotherapeutic equipment.

It is needless to say that only the most up-to-date and efficient types of apparatus have been installed. As regards diathermy, the striking feature is that only short-wave generators and inductothermy units have been adopted. The old-fashioned spark-gap generator finds no place in this very modern department.

As to medical electricity, the mains-operated combined-cabinet apparatus provides for galvanism, ionization, faradism and the sinusoidal current. Conspicuous by its absence is the popular radiant heat apparatus. The somewhat crude cabinets fitted with electric light lamps have not been included; there is, however, the modern Sollux type, but preference is given to the non-luminous infra-red generator.

In the ultra-violet section, the one remnant of the early days of actinotherapy is the carbon-arc. Apart from this, the equipment for both local and general treatment is of the electronic discharge-tube type, and naturally the Kromayer lamp is a self-contained unit.

The gymnasium is fitted with the usual plinths for massage, but preference is given to modern mechanical devices, among which are the rowing machine and the bicycle, for the movement of joints and limbs.

The hydrotherapy section provides a large, specially designed teak bath for allowing underwater exercises. In addition, provision is made for foam and aerated baths and for the needle spray.

The whole department is decorated in an attractive colour scheme, all apparatus being of the same colour—a deep rich cream; this lends uniformity to the general appearance.

Finally, individual dressing-cubicles are provided so that patients have privacy for dressing and undressing, even although treatment is mainly on the group system. It is an interesting point that patients do not mind having their treatment together, but strongly object to dressing and undressing in a common room.

The Department is staffed entirely by members of the Chartered Society of Massage and Medical Gymnastics who have the recognized qualifications.

It will thus be seen that all forms of physiotherapy are provided in one section, the whole being in the nature of a compact unit. There is no doubt that this Physiotherapy Department of the new Westminster Hospital marks a very great advance in Hospital practice, an advance which will, no doubt, be followed by others.

W. B

MANSION HOUSE MEETING IN SUPPORT OF EMPIRE RHEUMATISM COUNCIL

At a meeting held at the Mansion House on April 28th, with the Lord Mayor presiding, a resolution was adopted urging the community to support the Empire Rheumatism Council with the means to carry its aims to success. The Duke of Gloucester, President of the Council, in an interesting speech, said that it was surely proof of the solid strength of the British race that, in spite of discouraging circumstances, they could give attention to-day to a campaign intended to enlist their energies against the common enemy of human happiness, the forces of destructive disease. The Empire Rheumatism Council had undertaken a task of great importance, to seek out the causes of rheumatic disease and, therefore, the means of its prevention. Of sufferers from the disease there were, at a conservative estimate, over 1,000,000 adults and over 200,000 children in the United Kingdom.

Lord Horder said that the means for applying treatment in Great Britain were sadly lacking and that they must, somehow and soon, remedy this, because it was evident that, even though the incompleteness of knowledge of the causes of the disease handicapped progress, they already had to their hand systems of treatment which, if applied in the early stages and patiently pursued, would save the majority of sufferers from the curse of needless pain and subsequent crippling disability.

Sir William Willcox said that, in making their plans, the Council estimated that £500,000 from the home country and the Empire would be sufficient for the seven years' term of the campaign.

BRITISH RED CROSS SOCIETY CLINIC FOR RHEUMATISM: ANNUAL REPORT FOR 1938.

An examination of the annual report of this well-known Clinic shows that, during 1938, its many-sided activities were fully maintained The only factor which apparently prevents its even greater service in the public welfare is the lack of accommodation, which is becoming even more acute The very long waiting lists, especially for women, were indeed responsible on several occasions for closing the doors for limited periods to new applicants for treatment. Steps were taken to overcome this difficulty by regulating treatment, so that the treatment rooms were not blocked by patients who were not receiving sufficient benefit or who could be suitably treated elsewhere.

During the year there was a total of 88,671 attendances in the General Department, with 135,760 treatments, and in the Private Department a total of 7,881 attendances, with 10,698 treatments. The relative proportion of men and women attending was substantially as before. It is noteworthy that there is now a greater proportion of patients suffering from the earlier manifestations of rheumatism, but there are still too many advanced cases for whom treatment is likely to prove only palliative and prolonged. Of the completed treatments in 2,199 cases the following interesting figures are given: *Free from subjective symptoms*, 35.2 per cent.; *Definitely improved*, 50.8 per. cent.; *Unchanged, or only slightly improved*, 13 0 per cent.; *Worse*, 1.0 per cent These figures are surely sufficient proof of the splendid work being carried out by the British Red Cross Society Clinic in the fight against rheumatism.

THE CLIMATE OF MADEIRA

We have received a copy of a booklet entitled "The Climate of Madeira," which is issued by the local government authorities of that delectable island. Although this little work is a scientific exposition of the climatology of Madeira, even through the unromantic statistics which of necessity form much of its contents, there permeates a breath of the charm of the island.

Among the many facts of interest to students of climatology and to doctors who like to make an intelligent investigation of the climates to which they may feel inclined to send patients, is a detailed study of the meteorological conditions of the island with comparisons with other health resorts the climates of which are considered to be very good. It is impossible here to give a detailed resumé of the information, but it may be said that the general impression given is that Madeira is the possessor of an almost ideal climate and one which is eminently suitable as a general health resort for many types of invalids.

ST. MARYLEBONE AND WESTERN GENERAL DISPENSARY

The Annual Report for 1938 of this well-known Dispensary shows a small but steady growth in most of the Departments. The evening clinics continue to be very popular. The Physiotherapy Centre, where electrotherapy, massage, ultra-violet irradiation and breathing exercises are given under medical supervision, appears to be meeting a real need. For three months it was found necessary to double the working time of the assistant masseuse. In addition to old patients attending the Department, there were 55 new patients (20 children and 35 adults) for ultra-violet irradiation, and 93 new patients for other forms of physical therapy. The total number of treatments given was 3,413 (ultra-violet, 894; other treatments, 2,514).

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

Short-Wave Treatment of Ulcer of the Bladder

K. Feustel (*Therap. d. Gegenwart*, 1939, lxxx, 140) has treated 27 patients suffering from ulceration of the bladder. Short waves were employed at intervals of two days, at a distance of 10 to 12 cm., for 15 to 20 minutes. Of 27 cases, 7 were quite cured and 13 improved, while 7 discontinued treatment. The average duration of treatment amounted to 2 to 3 months, and represented 30 to 50 treatments. Only 5 of the cases were males Three cases are described: 2 were women aged 45 and 57 years respectively, and one was a girl aged 12 years.

Reactions Following U-V Irradiation During M & B 693 Administrations

R. Hallam (*Brit. Med. Jour.*, 1939, i, 559) reports a case of a man, aged 25 years, who received a one-minute exposure to ultra-violet light from a standard mercury-vapour lamp, at 40 inches, back and front. Five days later he suffered from what appeared to be an extensive second-degree burn; his temperature was 102° F., and his pulse rate between 90 and 108. The whole of the skin of the face was red, swollen and covered with brownish-black crusts. The skin of the chest, abdomen and lower two-thirds of the back was acutely inflamed. The patient had been taking one tablet of M & B 693 three times daily for urethritis for four days before the exposure to ultra-violet light. The author thinks that the man's skin was photosensitized by some chemical reaction following the use of M & B 693, and that the exposure to the dose of u-v light caused the intense reaction. The danger of exposure to strong sunlight or any form of artificial sunlight during the time the drug is being taken is pointed out.

Negative Galvanism in Hæmorrhoids

C. G. L. van Dyk (*S. African Med. Jour.*, 1939, xiii, 124) has treated 30 selected cases of hæmorrhoids by negative galvanism. A galvanic current from the negative pole is introduced into the lumen of the hæmorrhoid. This produces liberation of hydrogen gas, a disintegration of the blood with collapse of the intimal cells and deposition of the lamellated fibrin, followed by shrinkage and contraction of the tissue. This method of treatment was found efficacious only in cases of internal hæmorrhoids, non-protruding or protruding. The technique was as follows, and seems to have been suggested by Keesey, in 1934. The patient is placed in the left lateral position, the dispersive electrode, thoroughly moistened is connected with the positive pole and placed under the patient's left thigh, and the needle in the insulated handle is connected to the negative pole. The speculum is inserted to its full length and the needle electrode passed into the hæmorrhoid, the current is then gradually increased to 4 milliamperes. If the needle point is in its right place, the current increases of its own accord to 10 to 14 milliamperes, and this current is passed for 10 to 12 minutes; it is then slowly decreased and the needle removed. The needle must be inserted before the current is switched on and removed before it is switched off, or otherwise there is a danger of burning. Weekly treatments were given. Out of 30 patients, 25 were cured

Physical Therapy in Children's Diseases and Deformities

H. Crawford (*Med. Jour. Austral.*, 1939, xxvi, 182) discusses massage, movements and the use of physical agents in disease and deformity in children. Manipulations of all kinds may be given during massage in order to alter the local conditions. Movements may be active or passive, and may be forcibly carried out by the surgeon or by the masseur to break down adhesions or stretch tissues. Physiotherapeutic apparatus are considered to be of minor importance. Diathermy is rarely needed in children's diseases. Infra-red irradiation is of great benefit in cases of poliomyelitis. The heat cabinet cannot be used in children. In cases of deformity, breathing exercises are very important, and the parts can be stretched by some form of extension apparatus. In cases of club foot, manipulation and support influence growth and stretch the contracted tissues. Forcible manipulations should be carried out regularly by the surgeon and

Contd. at foot of next page.

SHORT-WAVE TREATMENT OF THE LOWER EXTREMITIES—*contd. from p. 137*

We must emphasize that a similar uniform distribution of energy cannot be achieved by using long-wave currents, if we leave the technically-complicated method of subaqueous diathermy out of the question. For this reason alone, the short-wave treatment of diseases of the lower extremities, particularly vascular diseases, is the method of choice.

Summary

For the purpose of short-wave treatment of certain diseases of the lower extremities a homogeneous field would seem to be desirable, whether one considers the heating effect itself or other specific effects as being present.

Fairly good uniform distribution of short-wave energy may be attained by employing unequal electrode distances, or rather so-called wedge-electrodes of a certain shape.

The use of wedge-electrodes, which must have precise dimensions, is therefore advisable for the purpose of uniform longitudinal short-wave heating of the extremities.

REFERENCES

KOWARSCHIK, J. *Kurzwellentherapie.* 1936.

SCHLIEPHAKE, E. *Kurzwellentherapie.* 1935

TOMBERG, V. "The specific qualities of electrical short waves." *Strahlentherapie.* 1936. Vol. 57.

GROAG, P. and TOMBERG, V. "The measurements of the temperature of the skin—a way of explaining the dosage of short waves." *Deut. Med. Woch.* 1937. No. 28.

TOMBERG, V. Report of the International Congress for Short Waves. Vienna. 1937.

CONTEMPORARY PHYSICAL MEDICINE—ABSTRACTS—*contd. from p. 145*

daily manipulations by the masseuse. Paralysis due to lead poisoning responds well to support and muscle re-education, combined with heat and massage. It should be remembered that healing should take place in the normal position in all cases of damaged muscles, absolute rest being indicated in the acute stage. Movements should not be begun as long as they cause pain.

Short-Wave Therapy in Skin Affections

A. Prokoptchouk (*abstr. Zentrlb. d. ges. Radiol.*, 1939, xxix, 400) finds that short waves act very favourably on trophic ulcer, lichen ruber planus, eczema, sycosis, pyodermic erythema nodosum, erythema induratum, neurodermatitis and sclerodermia. The temperature of the skin was raised by 1·5° to 2·0°. In experimental syphilis, the chancre was slow to develop, and its disappearance was accelerated after 8 to 12 treatments, the spirochaete no longer being found microscopically or histologically. In white mice, the development of cancer was prevented.

Short-Wave Therapy in Pulmonary Abscess

W. Dicker (*Forts. der Roentgenol.*, 1939, lix, 194) has treated 32 cases of abscess of the lung, 5 of which received treatment for from 1 to 4 days only, and were excluded, leaving 27 cases: Of these, 19 were cured, 3 were distinctly improved, 2 received only temporary benefit, 2 died, and 1 was still under treatment. This form of treatment is considered the best that can be adopted. The size and site of the abscess are unimportant, and multiple and bilateral abscesses can be treated successfully. The prognosis is bad if the abscess arises from a bronchiectasis. If lung gangrene has set in following the abscess, the treatment can still be employed. The treatment should be begun as early as possible and continued until all morbid changes have disappeared. Infiltrations around the abscess are favourably influenced by the use of short waves. Cure generally takes place by absorption, and toxic phenomena are not to be feared. High fever, a feeble circulation and a bad general condition are not contraindications. If an empyema of the pleura be associated with the abscess, the former should be evacuated.

Influence of U-V-R on the Reticulocyte Count

W. Grunke and H. Frommelt (*Klin. Woch.*, 1939, xviii, 453) employed ultra-violet irradiation during the winter months and noted its effect on the reticulocytes. The doses were gradually increased up to 46·8 unit minutes (15 minutes' radiation with the lamp 80 cm. from the chest and back). Courses consisted of 10 radiations in a month. The number of reticulocytes increased, the highest value being reached after six irradiations, and then decreased in spite of continuation of irradiations.

(Editorial pages concluded on p. 148.)

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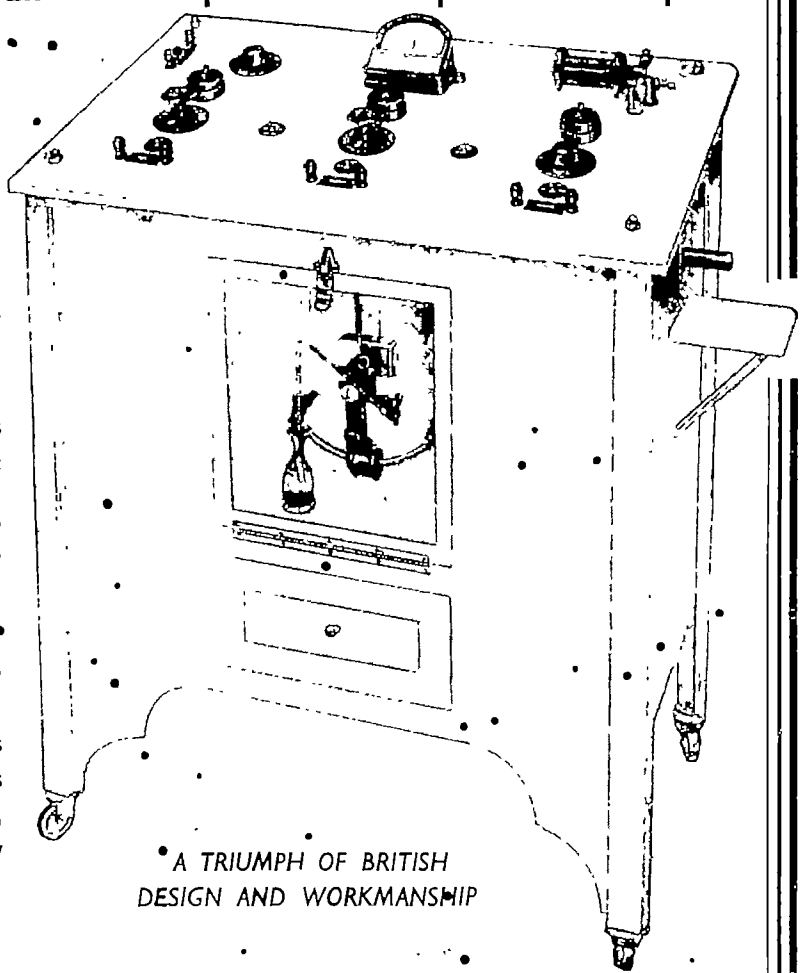
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A Further Lecture on Short Waves

The lecture given by Dr Francis Bach to members of the Society, on 18th April, proved of much interest, and was greatly appreciated by those members and visitors who were able to be present. Dr. Bach dealt with the scope of physiotherapy generally in rheumatism, and indicated the rôle of short-wave therapy in this disease, as well as its scope in other conditions. We hope that this lecture will be published in a future issue of the *British Journal of Physical Medicine.*

A second lecture has been arranged for Wednesday, 14th June, at 7 p.m., at the Royal Institute of Public Health and Hygiene (28, Portland Place, W.1). This lecture will be given by Dr. L. G. H. Sarsfield, M.I.E.E., A.Inst.P., and will deal with " The Theory of Short Waves." Dr. Sarsfield is already known to members as the author of the series of papers on " Electro-Medical Apparatus: Its Character, Operation and Care," which has been a feature of the *British Journal of Physical Medicine* for some time. The Executive Committee feels that they have been fortunate in securing the help and co-operation of Dr. Sarsfield for this lecture. Members are asked to take a note of its date and to make every effort to attend. The Committee feels that members should avail themselves, if it is at all possible for them to do so, of the opportunity this lecture gives them of hearing the theory of short waves explained and demonstrated by Dr Sarsfield. Short-wave therapy is becoming increasingly used in this country for a variety of conditions, and physiotherapists must know its underlying principles in order to administer it efficiently.

The fee for the lecture will be 3s., and non-member physiotherapists are invited to attend. As on the occasion of the first lecture, there will be some time afterwards for social discourse, when refreshments will be served. A formal notice of the lecture will be sent to members in London and the Home Counties, but it is hoped that some members at a longer distance may conveniently manage to attend. Physiotherapists who wish to attend this lecture are asked to advise the Honorary Secretary not later than Monday, 12th June

The next *Supplement* of the Society will be published and circulated to members with the June issue of this *Journal.* This will contain a report of the Executive Committee's work during this year as well as the Accounts for the year ended 31st March, 1939. The date of the Annual Meeting will also be given.

THE "REMATHERM" SHORT-WAVE THERAPY APPARATUS

We have received an interesting leaflet describing the "Rematherm 250" short-wave therapy unit, which utilizes the principle of electro-magnetic induction. The wave-length of this apparatus is 20 metres, and it is claimed that at this wave-length a higher percentage of useful output energy is secured and available for heating purposes, as the efficiency of the valve oscillator is greater. In practice the great advantage claimed for this apparatus is that the special cable applicator can be very simply and quickly applied to the region to be treated. The use of the electro-magnetic field and a flexible cable obviates necessity for the critical tuning adjustment of the apparatus and the careful selection and spacing of the electrodes. Various lengths of coil are supplied for the treatment of different regions of the body. With this method of cable applicators, too, movements of the patient's body during treatment do not throw the apparatus out of resonance. An interesting feature is the incorporation of a Patient Output Meter, which gives a convenient and practical means of calculating effective dosage The dosage supplied to the patient is readily governed, within wide minimal and maximal limits, by an Intensity Control device. While the short-wave current is being generated under correct working conditions, a neon indicator glows and serves as a guide to the conditions of oscillation. As soon as oscillation ceases as a result of an unsuitable technique or unfavourable patient load (or both), or owing to mains failure or current fault within the apparatus, the neon light goes out. Various safety devices are incorporated which ensure complete safety in operation. The metal case of the apparatus acts as an effective screen, and loss by random leakage-radiation is obviated. The mains input transformer is designed for continuous working on A.C. mains of the usual voltages and periodicities, but special voltages and periodicities are available to order. The apparatus is readily transportable. Full information and literature will be supplied on request to the manufacturers—Russell Electro-Medical, Ltd., 70, Wigmore Street, London, W.1

CORRECTION.—On page 122 of the April issue of this *Journal,* under the heading " Low Intensity Short-Wave Therapy," the address of the new Company mentioned should have been 17, Nottingham Street, London, W.1.

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PHYSICAL MEDICINE

AND INTERNATIONAL REVIEW

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THE BRITISH JOURNAL OF PHYSICAL MEDICINE

JUNE 1939 *And International Review* Vol. 2. No. 6. New Series

Original articles are invited on any aspect of Physical Treatment. Such articles are published only on the understanding that they are contributed exclusively to this Journal, *which does not hold itself responsible for statements made or opinions expressed by any contributor. The copyright of all articles appearing in the* Journal *is strictly reserved.*

Chemotherapy and Physical Medicine

ON page 150 of this issue there appears a highly interesting and important article by Dr. Albert Eidinow on an "Investigation into the Photo-Dynamic Action of Sulphanilamide Compounds." It is interesting to us because it deals with a subject of importance to those interested in actinology, namely the photo-sensitizing action of certain drugs, and it is important because it negatives the growing impression that the comparatively new, epoch-making drug, sulphanilamide, may not be used with impunity in conjunction with ultra-violet light, or even in patients who may be exposed to strong sunlight.

In our issue of November, 1937, we gave a digest of one of the first reports of a presumed photo-sensitivity to ultra-violet irradiation of patients taking sulphanilamide. The chief manifestation reported was a maculo-papular rash confined to the area of the body which had been exposed to ultra-violet light.

Since then, various other reports have seemed to confirm this effect of sulphanilamide. If true, such an effect would be unfortunate, in view of the truly remarkable success obtained with drugs of the sulphanilamide group during the past few years. Since Domagk, in 1935, made his now classical discovery that prontosil protected from death mice which had received a lethal dose of the *streptococcus hæmolyticus*, and so instituted a new era of chemotherapy, many remarkable applications have been found for drugs of the sulphonamide group. To mention only a few, puerperal fever, pneumonia, meningitis, and gonorrhœa have, considering their previous resistance to treatment, shown an amazing response to this new therapy. Even in erysipelas, we must admit, sulphanilamide has proved to be even more effective than ultra-violet irradiation. The complete story has not yet been told concerning the possibilities of this new chemotherapy, but, allowing for the over-optimism generally associated with all new forms of therapy which give initially encouraging results, it is at least established that sulphanilamide and its associated compounds have made a really outstanding contribution to our methods of combating infections.

On the debit side, it must be admitted that there are some disadvantages associated with their use, namely toxic reactions such as sulphæmoglobinæmia, agranulocytosis, and hæmolytic anæmia. Therefore, we repeat, that if we must needs add a serious photo-sensitizing effect, this would be unfortunate.

Dr. Eidinow has therefore made an important addition to our knowledge of this new and fascinating subject, and one which, in view of the already widespread and increasing use of the sulphanilamide drugs in every branch of medical practice, must be considered as of great moment.

As we have pointed out before, neither physical medicine nor any other specialized type of therapy can be divorced from general therapeutics. Each may have its special uses and advantages in certain circumstances, but each must be viewed in its true perspective and in its proper relationship to other branches of medicine. Physical medicine in the past, we have no doubt, may have suffered in the opinion of some not acquainted with its intrinsic merits, by the suggestion that it is a thing apart. Actually physical medicine is a highly practical and valuable branch of therapeutics, and should

Contd. on p. 158

INVESTIGATION INTO THE PHOTO-DYNAMIC ACTION OF SULPHANILAMIDE COMPOUNDS

By ALBERT EIDINOW, M.B., B.S.(Lond.), M.R.C.S.(Eng.), L.R.C.P.(Lond.)

Honorary Physician, the St. John Clinic and Institute of Physical Medicine, Pimlico, and the Light Department of the Radium Institute.

IT has been suggested that the sulphanilamide group of drugs act as photo-dynamic sensitizers to the luminous rays of light. D. Broeq Rousseau[1] 1935, has found that a 1-800 solution of mono-chlorhydrate sulphamido-azo benzine (C_{12} H_{13} N_6 O_2 S) HCL—known as rubiozol—will destroy streptococci grown in broth after exposure to the sun for ten minutes. Toxic effects, especially dermatitis, have been shown in several instances to be associated with exposure to sunlight (Menville and Achinard[2], 1937; Newman and Sharlit, 1937[3]; Frank, 1937[1].) Recently Rimington and Hemmings[5] (1938) have shown that the sulphanilamide drugs cause polyuria and increase the excretion of urinary and fæcal porphyrins. They have isolated and identified the chemical nature of the porphyrins excreted in urine and fæces, and suggest that the relative proportion of series I and series III porphyrins may prove helpful in explaining idiosyncrasies and toxic reactions. It is known that porphyrins of series III are less photo-sensitive than porphyrins of series I, and the cases showing toxic reactions allied to light sensitization may be those in which the excretion of series I porphyrins are in excess.

Clinical Investigation

Twenty-two patients who were having treatment for toxic arthritis, etc., at the St. John Clinic and Institute for Physical Medicine, Pimlico, S.W.1, were given two tablets of prontosil (Bayer) or two tablets of sulphonamide-P (Burroughs Wellcome and Co.) three times a day for ten days. Each patient had been taking 3.0 gm. of sulphonamide daily and in all 30.0 gm. were taken. During this period these patients were being exposed to (1) the tungsten-arc lamps for ten to fifteen minutes twice a week; (2) the carbon-arc lamp thirty to sixty minutes twice a week; and (3) the daylight lamp (Eidinow) for one hour twice a week. In addition to this they were all exposed to the natural sun and open air. No signs of skin inflammation were seen during this period, or later. Some patients complained of nausea and indigestion, and treatment had to be discontinued in two cases for this reason. There was no other evidence of light sensitization. When a circular area of skin, one inch in diameter, was exposed to the water-cooled mercury vapour lamp, the erythemal reaction was similar to that in other patients.

Tests in Vitro

Experiments were carried out to investigate the action of the sulphanilamide drugs on (1) streptococci; and (2) red blood-corpuscles. The added effect of exposure to light was observed. The photo-dynamic chemicals are known to have (1) a bactericidal action; and (2) a hæmolytic action of red blood-corpuscles, i.e., a solution of 1-50,000 of eosin will produce these results when exposed to yellow-orange rays. Each photo-sensitizer has a maximum action in a selected part of the spectrum, i.e., hæmato-porphyrin exerts its greatest action in the visible blue rays. The long ultra-violet rays from 4,000-3,300 Angström units also cause a photo-dynamic effect. The photo-dynamic action can only take place in the presence of oxygen. Many of the sensitizers are inactivated by the presence of the more complex amino-acids and proteins.

Bactericidal Action on Streptococci—Technique

A culture of hæmolytic streptococci was grown in Hartley's broth at 37° C. for 48 hours. 100 c.mm. of the culture were added to (a) 50 c.c. of saline; and (b) 50 c.c. of a 1-400 solution of sulphanilamide. 100 c.mm. each of suspension a and b were put into 10 c.c. of melted blood agar, the mixture being poured into a sterile Petri dish and put into the incubator for twenty-four hours. 100 c.c. each of suspension a and b were each put into a quartz flask and glass flask of 200 c.c. capacity. The four flasks were attached to an electric motor and were simultaneously slowly rotated in front of two quartz air-cooled vacuum mercury-vapour lamps, six inches distant. The mercury-vapour lamps were connected to a D.C. current of 210 volts and each lamp operated at 3.5 ampères and 140 volts between the electrodes. The flasks were immersed in a bath of cold tap water at 18° C., so as to keep them cool and ensure against excessive heating from the infra-red rays emitted by the lamps. At intervals of five minutes, 100 c.mm. of the suspensions a and b were removed from each flask and put into 10 c.c. of melted blood agar. This was poured into a sterile Petri dish and incubated for 48 hours.

The experiment was continued for thirty minutes exposure to the rays of the lamp.

The number of colonies of streptococci which grew out after forty-eight hours' incubation was counted. The results are recorded in Chart I.

From these experiments it will be observed that the bactericidal action of the ultra-violet rays is inhibited and delayed in the presence of sulphanilamide drugs. These drugs are photo-sensitive inasmuch as they are rapidly decomposed by exposure to ultra-violet rays emitted by the mercury-vapour lamp through quartz. The short ultra-violet rays of from 3,300 Angström units to 2,500 Angström units act powerfully after two to three minutes. A 1-400 solution of sulphanilamide in water or in saline, shows a reddish-yellow tint and finally precipitates. Exposed through a glass flask which filters off the ultra-violet rays from 3,300 Angstrom units, little visible decomposition is seen, but the bactericidal action is slower than on a similar suspension of streptococci in saline. The ultra-violet rays of a wave-length longer than 3,300 Angstrom units transmitted through glass have a bactericidal action on the streptococci employed in these experiments.

Spectroscopic examination of a 1-400 solution of prontosil or sulphanilamide put into a quartz cell 1.0 cm. thick shows that prontosil strongly absorbs all rays of a wave-length of 3,350 Angström units. A similar solution irradiated in a quartz flask for three minutes shows that the absorption is greatly increased and ultra-violet rays shorter than 4,000 Angstrom units are not transmitted. A turbid solution also absorbs much luminous rays. (See photograph).

Six different samples of the sulphanilamide drugs, as prepared by various firms of manufacturing chemists, were tested.

(1). Prontosil. (Bayer Products, Ltd.).
(2). Sulphonamide—P. (Burroughs Wellcome and Co.).
(3). Soluseptasine. (May and Baker).
(4). Sulphanilamide. (Crookes).
(5). Sulphanilyl glyc. (Crookes).
(6). Streptocide. (Evans).

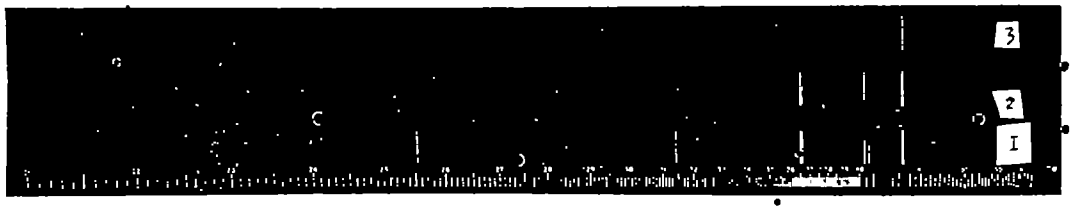
In each case the solution of 1-400 concentration gave similar results. The bactericidal action of sulphanilyl glycin appears to have a somewhat more powerful action. The suspension of 100 c.mm. of streptococci in saline or sulphanilamide solution, when grown out in blood and melted agar gave a large growth, which was impossible to estimate, as well over 4,000 colonies were present. The bactericidal

CHART NO. 1

	Number of colonies of streptococci which grew out from 100 c.mm. of suspension contained in 10 c.c. of—	Before Irradiation.	Time after Exposure to Mercury-Vapour Lamp					
			5 mins.	10 mins	15 mins	20 mins.	25 mins.	30 mins
I	Saline in quartz flask	†	†	—	—	—	—	—
	Saline in glass flask	†	†	‡	—	—	—	—
	Prontosil (Bayer) 1/400 in quartz flask	†	†	†	‡	—	—	—
	Prontosil (Bayer) 1/400 in glass flask	†	†	†	†	†	‡	—
II	Saline in quartz flask	†	†	—	—	—	—	—
	Saline in glass flask	†	†	‡	—	—	—	—
	Sulphonamide—p (Burroughs Wellcome) 1/400 in quartz flask	†	†	†	‡	—	—	—
	Sulphonamide (Burroughs Wellcome) 1/400 in glass flask	†	†	†	†	†	‡	—
III	Saline in quartz flask	†	†	—	—	—	—	—
	Saline in glass flask	†	†	‡	—	—	—	—
	Soluseptasine (May & Baker) 1/400 in quartz flask	†	†	†	‡	—	—	—
	Soluseptasine (May & Baker) 1/400 in glass flask	†	†	†	†	†	‡	—
IV	Saline in quartz flask	†	†	—	—	—	—	—
	Saline in glass flask	†	†	‡	—	—	—	—
	Sulphanilamide (Crookes) 1/400 in quartz flask	†	†	†	‡	—	—	—
	Sulphanilamide (Crookes) 1/400 in glass flask	†	†	†	†	†	‡	—
V	Saline in quartz flask	†	†	—	—	—	—	—
	Saline in glass flask	†	†	‡	—	—	—	—
	Sulphanilyl Glyc. (Crookes) 1/400 in quartz flask	†	†	†	‡	—	—	—
	Sulphanilyl Glyc. (Crookes) 1/400 in glass flask	†	†	†	†	†	‡	—
VI	Saline in quartz flask	†	†	‡	—	—	—	—
	Saline in glass flask	†	†	‡	—	—	—	—
	Streptocide (Evans) 1/400 in quartz flask	†	†	†	‡	—	—	—
	Streptocide (Evans) 1/400 in glass flask	†	†	†	†	†	‡	—
VII	Saline in quartz flask	†	†	—	—	—	—	—
	Saline in glass flask	†	†	†	‡	—	—	—
	M. & B. 693 (May & Baker) 1/4,000 in quartz flask	†	†	‡	—	—	—	—
	M. & B 693 (May & Baker) 1/4,000 in glass flask	†	†	†	‡	—	—	—

† = more than 5,000 colonies of streptococci.

‡ = 2—4 colonies of streptococci grew out in blood and agar melted plate.



SPECTROGRAPH.

(1) *Quartz Mercury-Vapour Lamp* 10 *secs. exposure.*

(2) *Transmission through* 1.0 *c.c. of a* 1/400 *solution of sulphanilamide in saline in a quartz vessel.*

(3) *Transmission through* 1.0 *c.c. of a* 1/400 *solution of sulphanilamide after* 3 *minutes of ultra-violet irradiation.*

action was clearly defined, as a sterile plate was seen after two or three days of incubation. These experiments indicate that the sulphanilamide drugs are decomposed by ultra-violet rays, but do not show a photo-dynamic action when tested on bacteria.

Photo-Dynamic Action of Sulphanilamide on Red-Blood Corpuscles

A similar series of experiments was carried out. A 1 per cent. suspension of human red blood-corpuscles was made by centrifuging a sample of citrated blood, collecting the red corpuscles, washing them with saline and finally making a suspension of 1.0 c.c. in 100 c.c. of sterile saline. 50 c.c. of this suspension was mixed with 50 c.c. of a 1-400 solution of sulphanilamide in saline. A similar preparation was made by mixing 50 c.c. of 1 per cent. suspension of red blood-corpuscles with 50 c.c. of sterile saline. 10 c.c. of the 0.5 per cent. suspension of red corpuscles in 1-800 sulphanilamide were put into (a) a quartz flask; and (b) a glass flask. 10 c.c. of the 0.5 per cent. suspension of red blood-corpuscles in saline were put into (a) a quartz flask; and (b) a glass flask. The four flasks were each attached to the wheel of an electric motor and were simultaneously exposed to the rays of two mercury-vapour lamps. The flasks were adequately cooled with water. The time taken for hæmolysis of the corpuscles was observed. The suspension of red blood-corpuscles in saline was hæmolysed in fourteen to twenty minutes when exposed in a quartz flask. In the 1-800 sulphanilamide solutions, agglutination and precipitation of the corpuscles, but no hæmolysis, was observed when they were exposed in a quartz flask.

A much weaker effect was seen in the glass flask; turbidity suggested a faint coagulation after two hours of irradiation. The 0.5 per cent. saline suspension of blood corpuscles in the glass flasks showed no change after two hours of irradiation.

It was, therefore, impossible to demonstrate hæmolysis of red corpuscles with sulphanilamide, and there was no evidence of photo-dynamic action.

Hæmo-Bactericidal Action of Sulphanilamide on Streptococci

Experiments were carried out to investigate the hæmo-bactericidal action of sulphanilamide in *vitro*, before and after exposure to light. The hæmo-bactericidal power was investigated according to the slide-cell technique described by A. E. Wright, L. Colebrook and E. J. Storer[5].

The irradiated sulphanilamide is decomposed after five minutes of irradiation and loses its bactericidal properties when treated in *vitro*.

The sulphanilamide anti-streptococcal drugs are sensitisers to light inasmuch as they are rapidly decomposed on exposure to ultra-violet rays of a wave-length shorter than 300 Angstrom units. There is no evidence that these drugs have a photo-dynamic action, but it appears that they strongly absorb some visible and long ultra-violet rays

CHART NO. 2

		Dilution 1/20	1/100	1/500
1	Number of colonies of streptococci which grew out in each 50 c.mm. of defibrinated human blood	200†	200†	72
2 (a)	Number of colonies of streptococci which grew out in each 50 c.mm. of defibrinated human blood containing sulphanilamide in a solution of 1/4,000	72	0	0
(b)	Number of colonies of streptococci which grew out in each 50 c.mm. of defibrinated human blood containing sulphanilamide in a solution of 1/8,000	200†	200†	68
(c)	Number of colonies of streptococci which grew out in each 50 c.mm. of defibrinated human blood containing sulphanilamide in a solution of 1/16,000	200†	200†	200†
3 (a)	Number of colonies of streptococci which grew out in each 50 c.mm. of human defibrinated blood containing irradiated sulphanilamide in a solution of 1/4,000	200†	200†	200†
(b)	Number of colonies of streptococci which grew out in each 50 c.mm. of human defibrinated blood containing irradiated sulphanilamide in a solution of 1/8,000	200†	200†	200†
(c)	Number of colonies of streptococci which grew out in each 50 c.mm. of human defibrinated blood containing irradiated sulphanilamide in a solution of 1/16,000	200†	200†	200†
	Number of colonies of streptococci implanted with each 50 c.mm. of human defibrinated blood	28,000	5,600	560

and inhibit the direct bactericidal action of light by weakening the intensity of irradiation. The irradiated solutions are decomposed and precipitate sulphur, and this solution is even more protective. The hæmo-bactericidal action of sulphanilamide *in vitro* is destroyed by irradiation.

Conclusion

Local and general ultra-violet irradiation may be safely applied in combination with drugs of the sulphanilamide group.

REFERENCES.

(1) ROUSSEAU, D. BROEQ, *Comtes Rendu. Soc. Biol.* 1935. Pp. 119-272.
(2) MENVILLE, J. G., and ARCHINARD, J. J. (1937) *J. Amer. Med. Ass.* 109, 1008.
(3) NEWMAN, B A., and SHARLIT, H. (1937). *J. Amer. Med. Ass.* 109, 1036.
(4) FRANK, L. J. (1937). *J. Amer. Med. Ass.* 109, 1011.
(5) RIMINGTON, C., and HEMMINGS, A. W. *Lancet*, April 2nd, 1938, pp. 770-776.
(6) WRIGHT, A. E., COLEBROOK, L., and STORR, E J. *Lancet* I. 1923 Pp 365, 417, 473.

One of the major advances in medicine at the beginning of this century was the recognition of the condition known as fibrositis in which, following an outpouring of plasma, there is proliferation of fibroblasts and a small round-celled infiltration. Later, there is organisation of the tissues, the fibrous tissue contracting and becoming avascular, and structures in its neighbourhood becoming pulled upon or strangled.

Another theory put forward was that a small globule of fat became surrounded by a fibrous sheath. If this theory be correct, injection into the globule of fat, or forcible crushing of the sheath by medical manipulation and deep massage would disrupt the sheath, releasing the fat globule and so relieving tension and pain.

I have now examined and treated a very large number of cases suffering from the type of pain described, mostly chronic sufferers of several years' standing and have cured the majority. I have picked out some of the old chronic cases attending the Electrical Department of St. Bartholomew's Hospital who have been treated for long periods without relief, and have secured marked temporary relief in all except one case of arthritis of the acromio-clavicular joints, and cure in a very large proportion. It will be recognised that the chronic out-patient at a hospital is the most difficult type of all to cure.

If a point is found which is tender both to deep palpation and to a faradic current, cure can be practically guaranteed.

If a mild faradic current does not cause pain, the amount of current should be continuously increased to the limit of the patient's tolerance. Often a heavy current will pick out a point of pain which a light or medium current will miss. This indicates that the lesion is deeply seated, three inches or more—below the body surface. In spite of this fact the faradic sensitivity is likely to be strictly localized to an area $\frac{1}{4}$ inch or less in extent on the skin surface. Experience only can teach where the area of faradic sensitiveness may be. A pain in the calf may be referred from an area adjacent to the lumbar vertebræ.

In very many cases careful examination will show that the lesions are strictly bilateral. The points of faradic sensitiveness having been identified and marked with a skin pencil, treatment is instituted.

The skin is sterilised with spirit and, at each marked point, a few drops of novocaine are introduced under the skin. A 10 c.c. syringe filled with a $\frac{1}{2}$ per cent. novocaine solution, and fitted with a blunted $2\frac{1}{2}$ inch serum needle, is now used. The blunt needle is forced through the anæsthetized spot on the skin exactly at right angles to the skin surface. At some point in its onward progress a sharp pain is caused, which often radiates to the site of the pain previously complained of. At and around this point half the contents of the syringe are injected. The needle is then driven deeper, and usually about an inch deeper another and probably more painful spot is encountered. Here the syringe is emptied. With increased experience these spots can be almost invariably found. The joints, including vertebral joints in the neighbourhood, are manipulated, often to the accompaniment of sharp snaps as the fibrous tissue gives way, and the area is subjected to heavy deep massage in the course of which fibrous nodules can usually be felt and broken up. Other forms of physical therapy, such as heating by infra-red rays or short-wave diathermy, are often used in addition. At this point, I may comment that short-wave diathermy is contra-indicated in cases of true neuritis as likely to increase the pain, and only athermic short waves can be used with advantage. This, to my mind, is a proof that these cases I am describing are not cases of true neuritis.

Often one treatment is sufficient to remove most or all of the pain, even if of very long standing. If the pain returns, treatment may have to be repeated several times. In the event of a recurrence of pain it will usually be found that the previously-injected

THE NATURE AND TREATMENT OF CERTAIN TYPES OF REFERRED PAIN

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THE types of pain dealt with in this article are varied in nature. Most of them are referred to me for treatment as being some form of "neuritis" such as acute or chronic sciatic neuritis, brachial neuritis, intercostal neuritis, neuralgia, radiculitis, etc. Most of the remaining cases are lumbago, lumbar pains, intractable headaches, "rheumatism," and even arthritis. Some cases may be accompanied by hyperæsthesia, paræsthesia, and even muscle wasting and loss of tendon reflexes.

The vast majority of the patients are of a "rheumatic" type, and their symptoms are often of long standing, although sometimes they are very acute, as in the case of an acute lumbago. They are very irresponsive to treatment by any ordinary means, and it may take many months of such treatment before even temporary relief is obtained. In my opinion they are probably mostly fibrositic in origin and correspond to the "somatic" pains of Kellgren, who, however, is inclined to deny even the existence of "fibrositis." When properly investigated and identified, they are usually very easy to cure either by injection of large quantities of a weak solution of a local anæsthetic, by manipulation, or by a combination of both.

For many years it has been known to medical electrologists that, in many cases of chronic "neuralgia" or "neuritis," careful examination with a very small exploring electrode through which a faradic or sinusoidal current is flowing will reveal certain exquisitely sensitive local spots on the skin in the region of, or central to, the pain which can be picked out; these spots are so small that a $\frac{1}{2}$ inch electrode completely covers them. They appear to be about the size of an ordinary safety-match head. If a needle, through which a very mild galvanic current is flowing, is driven through these spots at right angles to the skin surface, acute pain, often radiating along the area in which the previous pain had been complained of, will usually be elicited at a point deep to the skin. If the needle is kept steady on that point, and a galvanic current of very small milliamperage is passed for a short period, the neuralgic pain is often permanently relieved. It has always been assumed that some small sensory nerve fibres conveying the pain have been destroyed by the electro-chemical action of the direct current, or alternatively that electro-chemical action close to the nerve has set up a very local counter-irritation. The needle is covered, except at its tip, by a shellac varnish, so that no other tissue along its course is damaged. The current used is one capable of softening and destroying fibrous tissue.

For some years past Professor Leriche has practised the injection of mild local anæsthetics around arthritic joints. He has found that the local relief of periarticular pain has lasted much longer than would be expected from the use of a local anæsthetic, that after each injection the period of relief tends to be longer, and that eventually many cases are relieved more or less permanently.

Kellgren has found that, in many cases of what he describes as "somatic" pain, there are points tender to palpation either inside the painful area or very often outside, and situated between the painful area and the spinal cord. Injection of these points with a local anæsthetic often abolishes the pain, temporarily or permanently.

If, instead of trusting to the locating of places tender to palpation, he had accurately identified such points by means of a faradic current, I think he would have found that his proportion of successful results would have been very much greater.

spots are no longer sensitive to faradism, but that the use of a heavier current discovers less sensitive spots which had been previously missed.

To sum up, I have described certain types of acute, and more often chronic, pain which may be relieved by one or more of the following types of treatment:

(a) The passage of direct current which softens down and liquefies fibrous tissue.

(b) The injection of large quantities of local anæsthetics at the site of the pain, a procedure which is likely to stretch and disrupt fibrous tissue.

(Here I must interpolate my fixed opinion that, in many of these cases, a vicious circle is established, namely pain causing muscular spasm and muscular spasm causing pain. In most of these cases intense local spasm can be detected. The local anæsthetic temporarily relieves the pain, and consequently the spasm, and breaks the vicious circle as well as possibly stretching the fibrous tissue).

(c) Manipulation of the joints which stretches and snaps the fibrous bands uniting the joints and strangling the nerves.

(d) Deep massage which tears apart overlapping planes of muscle tissue, disrupting fibrous adhesions which bind them together.

(e) The application of heat which softens fibrous tissue.

Each of the forms of therapy effective in curing these pains has the power of destroying or disrupting fibrous tissue. Can one possibly doubt that these lesions are usually caused by new formation or fibrous tissue, or "fibrositis," usually secondary to a septic focus in the body, but probably also capable of resulting from a local chill, trauma, metabolic fault, or disuse or postural deformity? Most of these cases have palpable fibrous nodules, and bands of fibrous tissue or adhesions, and I believe that the pain is caused by reflex irritation of nerves adjacent to the nodules, local spasm of muscles induced by inflammation and pain caused by pressure on these nodules or bands, or strangulation of nerves by the adhesions.

Apart from this direct causation by fibrous tissue formation, there is also, I believe, another and indirect action. Some of these cases show other symptoms than pain. There may be numbness, tingling, wasting or disorders of the circulation in the affected limb. These I believe are caused by some agent, the nature of which is unknown to me, although again the cause may be strangulation of a part of the sympathetic nervous system. To confirm this opinion I shall mention two conditions:

(1) Fibrous adhesions binding together the cervical vertebræ are very common indeed, giving rise to such symptoms as chronic severe occipital, frontal and temporal headaches, and so-called brachial neuritis. Manipulation of the neck in these cases is of great value and is very frequently practised by physiotherapy practitioners. In some cases, if careful observation be carried out, during the manipulation the pupil of one eye may be seen suddenly to dilate, there may be one-sided flushing of the face, or both signs may appear at once. It is obvious that there has been some action on the sympathetic nervous system.

(2) I have cured very many cases of primary dysmenorrhœa in virgins and nulliparæ by manipulation of the lumbo-sacral spine and sacro-iliac joints. In every case I have been surprised to find that, in spite of the tender age of the patients, there have been widespread adhesions between the spinal vertebræ and in the sacro-iliac joints. Whenever I hear these adhesions snapping, I am practically certain that the patient will be cured of her dysmenorrhœa. If I do not hear the snap, I can be moderately certain that on examination I will find a causative cervicitis.

This causation of dysmenorrhœa by the formation of joint adhesions and the cure of the complaint by the breaking down of adhesions, can, I contend, only occur through the action of the sympathetic nervous system.

Space does not permit of the description of more than a very few illustrative cases:

Case 1 A man of 70 referred to me by a neurologist as a case of chronic sciatic neuritis;

He had had a very severe attack of acute sciatica two to three years ago. Ever since then he had chronic pain down his thigh and calf. Four tender points were picked out by faradism on his buttock and sacro-iliac region These were injected to a depth of about 2 inches with a ½ per cent. novocaine solution, and his sacro-iliac joints were manipulated. There was immediate relief of pain. When I saw him again, 48 hours later, he said that the pain was practically gone. Three mild short-wave diathermic treatments removed the pain completely.

Case 2. A lady with general fibrositis had intense pain in the region of her right elbow with marked weakness in gripping and wringing movements. Tender points were isolated by palpation and faradism, and injected. There was a reaction of pain a few hours later (this often happens). Following this, there was very marked relief of pain and increase of power, and she was able to do work which she had been unable to do for six months past. The elbow is still improving without further treatment.

Case 3. A young man of 28 was suddenly attacked by typical acute "lumbago." After a fortnight there was no relief of pain. On examination, three spots sensitive to palpation and faradism were found on either side of the spine in the costo-vertebral angle. These were injected and the spine manipulated, and he was told to get off the couch and touch his toes. This he did without pain or effort. There was no return of pain, but a slight tenderness remained, which disappeared after a few days of inductothermy and massage.

Case 4. A hospital patient who had been attending as an out-patient for seven years was examined. He complained of severe pain in the region of his shoulder-joint. He could not lie on the affected side. Points tender to palpation and faradism were found deep to the trapezius muscle and close to the second, third and seventh cervical vertebrae. A combination of injection and manipulation, given on four occasions, cleared up his pains.

Case 5. A middle-aged man, seen in consultation with a general practitioner, had had very severe lumbago for several weeks. After being injected and manipulated he got off the couch, touched his toes, and said he felt "like a two-year-old."

Case 6. It is stated that in Paget's disease the most distressing symptom is the intractable backache "for which little or nothing can be done" Recently a gentleman of 73 years of age, with a very advanced Paget's disease, was sent to me. Sixteen points, eight symmetrically placed on either side of the lower dorsal and lumbar spine and along the sacro-iliac joint and crest of the ilium were identified by faradism and injected. Immediate complete relief of pain lasting five days was obtained, and he was able to enjoy a seven-mile brisk walk. There was then some return of pain and he was re-injected with the same result. At the time of writing this article there has been no further return of pain. Going on previous experience of arthritic spines, I anticipate, after a longer interval, a return of pain, which should again disappear on injection. After this has occurred several times, the relief should be very prolonged or permanent.

To prevent recurrences it is of course necessary to track down and deal with any septic focus. Many cases are women of about menopausal age with pains in the shoulder-girdle or arms. In practically all such cases examination will show a cervical erosion which must be dealt with by general pelvic, followed by cervical, diathermy.

My general conclusion is that true chronic neuritis of any kind is a rare condition, and cases which appear to be such are usually cases of referred pain caused by a fibrositic lesion which can be identified by a faradic current and dealt with by novocaine injections. The results of treatment in these cases, and in others in which I assume the pain to be referred from fibrositic deposits, are almost invariably very satisfactory.

CHEMOTHERAPY AND PHYSICAL MEDICINE—*Contd. from p. 149*

in many cases be used as an adjunct to other forms of treatment, while, conversely, other forms of treatment, such as drug therapy, can often be employed with advantage as a useful supporting measure to physiotherapy. If every specialist and general practitioner had realized this fact, what a different story might have been told concerning the progress of physical medicine in this country. Only by the harmonious and balanced co-operation of all branches of the healing art can the optimal results be obtained for suffering humanity.

THE "AERATONE" THERAPEUTI BATH

By PROFESSOR WILLIAM CLIVER, B.Sc., A.M.I.C.E., F.R.S.E.
University of Edinburgh

THE treatment of rheumatic and muscular troubles, nervous disorders, skin diseases and heart troubles by means of medical baths is an age-long practice, and many types of bath have been invented to increase the power and efficiency of the treatment. The "Aeratone" bath adds yet another type to the long list already available to the medical profession. Its chief claim to consideration is that, although only well-known hydraulic principles are made use of, these are applied in a novel way to produce a bath whose chief characteristics are simplicity, safety in use, and increased power and effectiveness in the treatment of a wide range of ailments.

The "Aeratone" bath developed out of research work in the field of hydraulics carried out by the writer in the course of his professional work, and a chance word dropped by a friend who had been undergoing treatment for heart trouble at a Continental Spa. An association of ideas led to the development of a bath which, at the preliminary trials, gave promise of being a luxury bath of a rather unique type, but hardly gave any indication of its power as a curative agency. The curative and tonic values of the bath gradually became apparent as a result of demonstrations given to some of the writer's medical colleagues in the University of Edinburgh, and research work extending over a year, carried out on behalf of some of the senior Edinburgh physicians on various types of patient, confirmed that the "Aeratone" bath treatment represented a substantial advance in the field of hydrotherapeutics.

Although some three thousand five hundred treatments have been given and much valuable data has been accumulated, a great deal of controlled research work remains to be done in order to explore fully the possibilities of this new form of treatment. The preliminary work, however, shows conclusively that there has been placed at the disposal of the medical profession a very potent piece of apparatus which opens up a promising field of treatment for such stubborn complaints as rheumatism, fibrositis, arthritis, neuritis, sciatica, lumbago and muscular troubles, as well as cases of mental depression, lethargy and high blood-pressure.

Description of Apparatus

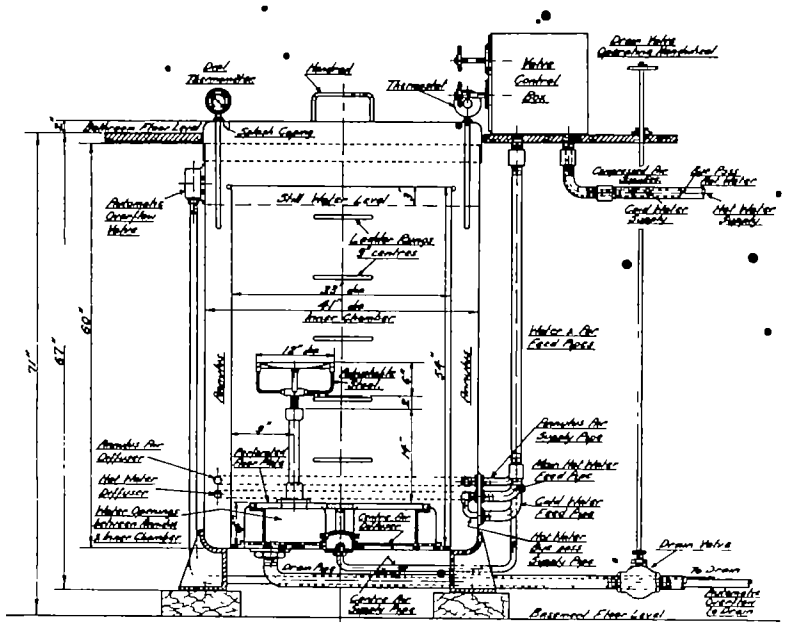
The "Aeratone" Therapeutic Bath comprises three pieces of equipment: (a) the bath, (b) the control desk and (c) the air compressor.

(a) The bath consists of an outer vertical water-tight cylinder, open at the top, and an inner concentric open-ended cylinder, the latter forming the treatment chamber and entered by means of a removable ladder. The treatment chamber is provided with a perforated floor plate carrying a perforated adjustable stool upon which the patient sits so that the shoulders are level with the top edge of the inner cylinder. The central air-diffuser is mounted below the perforated floor plate. The outer air-diffuser and the hot-water diffuser are disposed round the bottom of the annular space between the wall of the treatment chamber and the outer cylinder. A substantial emptying valve is provided for rapidly emptying the bath as well as an overflow orifice. The bath is of welded and polished stainless steel construction throughout, presenting a smooth and easily cleaned surface with no corners and in line with modern hygienic ideas.

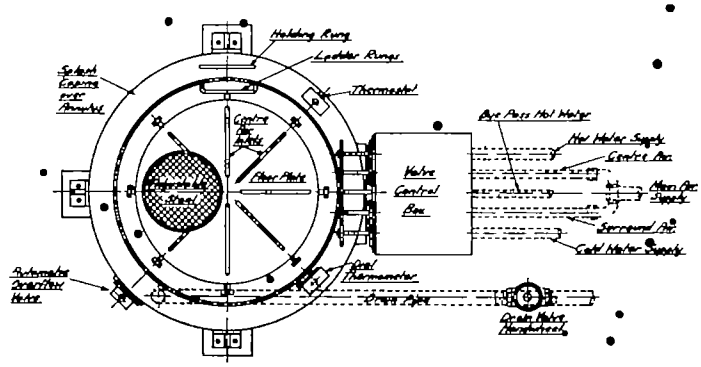
(b) The control desk, fabricated in welded and polished stainless steel tubing and angles, carries polished bakelite panels on which are mounted the following gauges

and valves: (1) a dial thermometer, (2) an air-pressure gauge, (3) a hot-water valve, (4) a cold-water valve, (5) a cold-spray valve, (6) a valve controlling the central air, and (7) a valve controlling the surround air.

(c) The air compressor is of the sliding-vane blower type and is driven through a tex-rope drive by an electric motor. The compressed air passes through a non-return valve into a small balancing air receiver and thence to the bath. The equipment includes an air-inlet silencer, an air outlet silencer, a safety valve and an air filter. The electric motor is started and stopped by means of an automatic self-acting starter actuated by a pressure regulator connected to the air receiver. After the main supply switch to the motor is closed, complete control of the motor is obtained by the operation of the air valves at the control desk. There are, therefore, no electrical connections near the bath and consequently entire absence of danger from electric shock, either to the patient or to the attendant.



Partial Sectional Elevation of "Aeratone" Therapeutic Bath.



Plan View of "Aeratone" Therapeutic Bath.

It should be noted that there are no mechanical moving parts in the bath—only air and water—and every care has been exercised to provide a smooth, rounded design throughout so that patients can be encouraged to move about freely in the treatment chamber without danger to themselves.

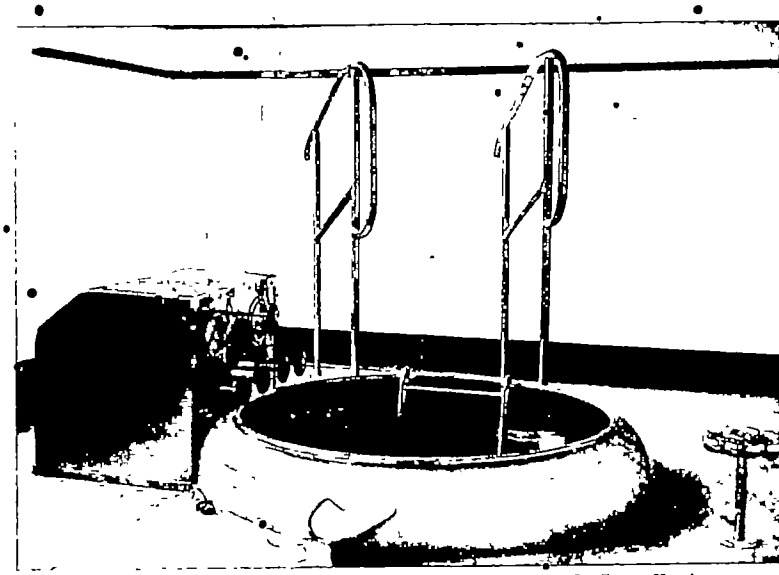
Operation

The bath being simple to operate, requires no special technical knowledge or skill and the bath attendant soon acquires the necessary experience to apply the prescribed form of treatment for the different types of patient. Complete control of the conditions inside the bath is effected from the control desk, and the temperature and weight of vibrating hydraulic massage can be varied to suit the patient.

The bath is filled with water at the desired temperature to a level of about six inches below the top edge of the treatment chamber. The patient is then introduced

and seated comfortably on the adjustable stool in the treatment chamber. The patient's shoulders should be level with the top edge of the treatment chamber. The water level will now have risen about four inches, due to displacement by the patient's body.

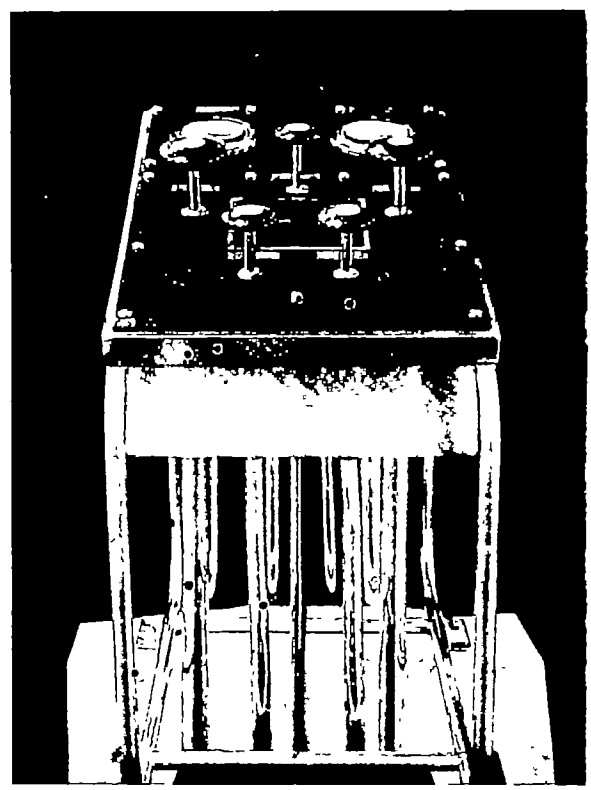
The surround air valve is now gradually opened and air enters the water contained in the annular space between the walls of the treatment chamber and the main bath vessel. The effect of this air is to reduce the density of the water in the annulus relative to the water in the treatment chamber and, as these two liquids are in direct contact under the bottom edge of the inner cylinder, the heavier liquid in the



Sunk Type " Aeratone " Therapeutic Bath Installation.



" Aeratone " Therapeutic Bath Installation, showing patient undergoing treatment.



Control Desk for " Aeratone " Therapeutic Bath.

treatment chamber presses down under the inner cylinder and pushes the lighter liquid upwards until it pours over the top edge of the inner cylinder in a cascade into the treatment chamber, forming a continuous downward flow in the treatment chamber during the whole period of the treatment.

The central air-valve is now gradually opened and air bubbles enter the treatment chamber from the air diffuser situated below the perforated floor plate. These bubbles form an ascending stream struggling vigorously upwards against the retarding downward flow of water from the annulus. This struggle causes the air bubbles to vibrate as they pass upwards, continually striking and rebounding from the surface of the patient's body. As each bubble comes in contact with the skin, a quantity of water is pushed away from the skin and on the rebound the water rushes back to fill the space left by the rebounding bubble, causing a slight depression of the skin at the point of contact. When it is realized that each bubble, during its ascent through the treatment chamber, comes in contact with the patient's skin many times and that there is a vast number of bubbles steadily ascending throughout the period of treatment, some idea is gained of the extent and character of the vibrating hydraulic massage being applied to all parts of the patient's body simultaneously under relatively constant temperature conditions. Since the patient is sitting upright in the bath, the application of this massage is in general at right angles to the vertical axis and the patient is therefore exerting no fatiguing muscular reaction, but is, in effect, in a condition of complete and pleasant relaxation. The upward flow of bubbles and the downward flow of water gives the patient a sense of lightness which encourages freedom of movement, a very valuable characteristic, especially in the treatment of arthritis. During the period of treatment the muscles of the body are in a state of gentle vibration while the blood circulation is simulated to a high degree. At the termination of a treatment, which lasts from fifteen to twenty-five minutes, depending on the patient, it will be found that the skin condition appears to be unchanged and there is no redness similar to that resulting from immersion in a still hot bath at the same temperature. In fact the patient comes out of the bath feeling stimulated and energized, while he experiences a pleasant internal glow which persists for hours and which may be termed a circulation glow. In some cases this glow has persisted for twenty-four hours.

It is too early yet to judge of the permanency of the effects of treatment in the "Aeratone" Bath, but, from the evidence so far available, the effects seem to persist for months after the termination of a course of treatment. Indeed, in many of the cases tested, improvement continues long after the baths have been stopped.

It is difficult to convey adequately in print the effects and sensations experienced during treatment in the bath, but it is universally agreed that the treatment is very pleasant, and patients look forward with keen anticipation to subsequent treatments.

Field of Application

As already indicated, the field of application for this new bath is very wide and, although a considerable amount of research work has been done, this research work has been mainly confined to rheumatism and allied complaints. There is every reason to believe that many other ailments outside the rheumatic field will respond to the "Aeratone" treatment. This belief is based on a number of snap trials made during the course of the researches. For instance, a case of extensive œdema in an elderly man whose legs were very swollen responded to one treatment, and the legs were reduced to a practically normal condition after twenty minutes' treatment, the water temperature being about 100° F. This particular patient also experienced considerable kidney stimulation, a condition which has been noted in other elderly patients. Another interesting case was that of a middle-aged woman suffering from urticaria which caused widespread irritation and loss of sleep. This case had defied ordinary methods of treatment and could only be kept in check by relatively frequent applications of an

ointment. Two treatments in the bath, at intervals of two weeks, resulted in an entire absence of the former irritation, and no further applications of the ointment have been necessary. Strains and sprains arising from athletic activities have received a certain amount of attention and the results obtained have proved very encouraging. For instance, a case of severe ankle strain in which the ankle was very swollen as a result of a football injury responded to a treatment daily for five days, the man being able to play on the following Saturday ; according to a Press notice, he showed no signs of his former week's injury. This injury, at the time of its occurrence, was expected to keep the man off the field for at least three weeks. Another case treated was of a somewhat more severe character and the doctor's report is given below in full :

" On November 10th I examined Mr. H. L., who has sustained a recurrence of a football injury which has incapacitated him for a month, during which time he has had a course of massage and diathermy.

" On examination I found that he had apparently torn some of the fibres of his left hamstring muscles. There was great tenderness at a point on the posterior aspect of the limb, at the junction of the upper and middle thirds. With the knee extended, flexion of the thigh on the body was extremely painful, and the patient, on stooping with the knees extended, could barely reach a point two inches below the knee.

" Mr. H. L. was given a course of the new ' Aeratone ' Therapeutic Bath treatment, and two administrations were given daily.

" Four days later there was a marked improvement, and on the 18th all traces of pain had disappeared.

" The legs could be flexed and extended fully and equally, and there was a complete absence of local tenderness.

" The result was remarkably good, and in my experience much better than might have been obtained by massage and similar therapeutic measures.

" As the injury is one which is apt to recur under conditions of severe physical strain, I have advised Mr. H. L. to refrain from playing football till after Christmas."

This man played the day following Christmas without any recurrence of the trouble and has played regularly since that time. Ordinarily, as the doctor pointed out, an injury of this character usually means an absence from play for a whole season.

Reverting to the question of permanance of the effects of " Aeratone " treatment, the following medical report may be of interest :

" This is to certify that I have examined Mr. H. S., aged 43, on the 16th of August, 1938.

" He gave a history of rheumatism affecting the feet and legs for more than two years. He had had treatment at Buxton upon two different occasions with considerable benefit, but the ankles were still very stiff, and the 2nd, 3rd and 4th toes of both feet were very nearly fixed in the hyperflexed position, the metatarso-phalangeal joints also were very painful and stiff, especially on the dorsal aspects. There were no other signs of rheumatism and no fibrositis. He was 11 st. 1½ lbs. and was feeling only fairly fit on account of the fact that he was never completely free of pain when he was on his feet, and in consequence could only walk about half-a-mile at a time.

" He has had an ' Aeratone ' bath daily, each bath being of only a quarter of an hour's duration. During the bath he manipulated his toes both voluntarily and passively with his hands. I saw him again to-day, the 22nd August, and found that in the interval he had been able to walk much further without pain. On Saturday, 20th August, he had actually walked 7 miles in all without difficulty. He was looking a fitter man, had a good colour, and had a distinctly brighter and happier appearance This greater feeling of well-being I would attri-

bute to the greater freedom from pain and to the greater ability to take healthy exercise and also to the tonic effect of the bath. The ankles were distinctly suppler than they had been and there was greater active mobility of the toes. Passively, the metatarso-phalangeal joints could be moved more freely and could actually be pulled out almost to the straight position. It will probably take a long time, if ever this can be done, to attain full flexion of the toes."

The following improvements are definite: (1) The metatarso-phalangeal joints are less painful. (2) The dorsum of the foot is no longer painful when walking. (3) The ankle joints are suppler.

The writer interviewed this man on the 3rd of April, about seven months after the completion of his treatment, and found that his condition had actually improved, and that he had put on a stone in weight and expressed himself, as indeed he looked, very fit indeed. It is interesting to note that, prior to his "Aeratone" treatment, this man had to be driven by car to and from his work, whereas he now takes pleasure in walking there and back and is now as active in his movements as his business colleagues.

The following report gives in general terms the views of a senior Edinburgh physician as addressed to one of his London colleagues, and is interesting in that it gives an indication of some of the ailments tested under the supervision of one who has made a careful study of the "Aeratone" treatment:

"I have been much impressed with the effect of the 'Aeratone' Bath. Between three and four hundred immersions altogether have been given to patients of mine. This has given me an opportunity of studying different types of conditions as affected by the bath. Fibrositis, panniculitis, monarticular and multiple arthritis, sciatica, lumbago, chronic constipation, even mental depression and lethargy, and raised blood-pressure in elderly people—such are the cases that have been treated.

"The effect of the bath is to cause an alternate suction and pressure upon the skin all over the body. This alternate suction and pressure seems to have the effect of increasing the peripheral circulation as well as relaxing the arterioles, and so reducing high blood-pressure; of relaxing muscle spasm, and so diminishing pain in certain acute cases; of giving the patient a general feeling of well-being, almost of enjoyment, and of causing slight diuresis and improving bowel elimination. It increases the action of the skin, but the diaphoretic effect need not be great.

"At no time have I observed a tendency to faint after the bath. Indeed, the heart appears to have been stimulated as a result of it.

"If desired, the heat of the bath can be regulated. Each patient is treated according to his or her requirements, as to heat of the bath and length of time of immersion. Patients should be advised by their medical men as to movements while in the bath (if these are permitted at all), similar to what is suggested in immersion in other baths of a hydrotherapeutic nature.

"I think that this bath is an improvement on all the others that I have known on account of its stimulating rather than depressing effect, and of the fact that the patient is not hit or beaten by the action of air and water, so that there can be no injury.

"I am of the opinion that the bath has been tried out sufficiently long now to make one confident that it is, as I say, an advance on other hydrotherapeutic measures."

Although relatively a new-comer to the field of hydrotherapeutics, the "Aeratone" bath is being installed in many different institutions, where it will be used primarily as a curative agency, though its general tonic effects should not be overlooked. As a "keep fit" adjunct, it should be of service in public baths, while athletes of various types will find in it a means of keeping the joints and muscles free and supple.

SOME EXAMPLES OF DIATHERMY AND SHORT-WAVE APPARATUS

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Continuing the Series of Papers on

ELECTRO-MEDICAL APPARATUS : ITS CHARACTER, OPERATION AND CARE: PART II. No. 10

BEFORE considering the details of some diathermy and short-wave machines, a word or two must be given on the use of coil, or cable " electrodes " with high-frequency currents. In this technique the current passes from the generator through a cable which is formed into a coil or loop to encircle or lie upon the region to be treated.

With this arrangement there is at the shortest wave-lengths a combination of a condenser-electric field with an electro-magnetic field, but the effects of the latter are generally predominant. To deal first with the condenser effect of the coil, it should be

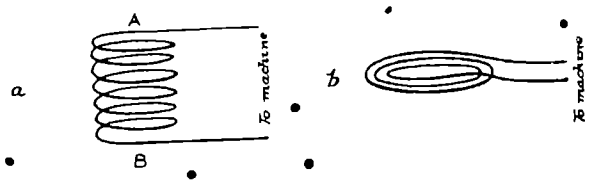


Fig. 146 (above).—Two ways of using cable in short-wave work.

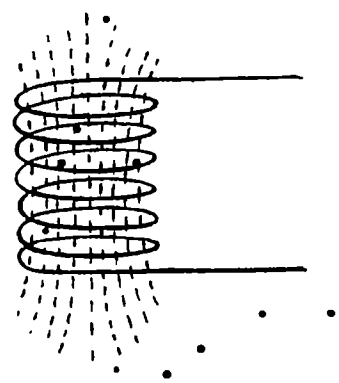
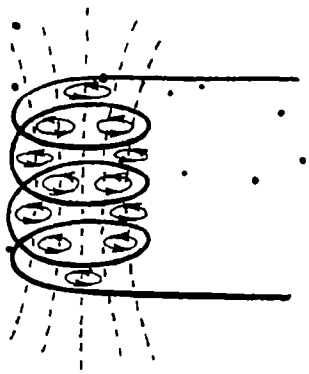


Fig. 147 (right).—Magnetic field within a coiled cable indicated by dotted lines.

noted that, at the very high frequency of the current, the turns of the coil, although they are formed of a continuous conducting cable, behave to some degree as condenser plates. If, for example, the coil is helical, as shown in Fig. 146a, the turns form a number of condensers in series and a weak condenser-field threads the coil. If, however, the coil is a spiral or " pancake " as shown in Fig. 146b, the condenser field between turn and turn has little effect on the patient.

The major effect of the cable arrangement is due to the magnetic field set up within and around the coil. This field, produced by induction in the manner explained in an earlier paper,* is illustrated in Fig. 147. It gives rise to eddy currents (or vortex currents) in the conducting tissue. These eddy currents are local currents in small closed electric circuits formed in the tissue and in the electrolytic fluids comprising the organic substances in the field. An attempt is made in Fig. 148 to give an impression of how the eddy currents might be distributed through the substance in the field. The eddy currents produce heating. The currents, and consequently the heating effects, are greater in the regions of comparatively high conductivity than in the bony and fatty parts.

*B.J P.M., 1937. Vol. 12, page 11, May.



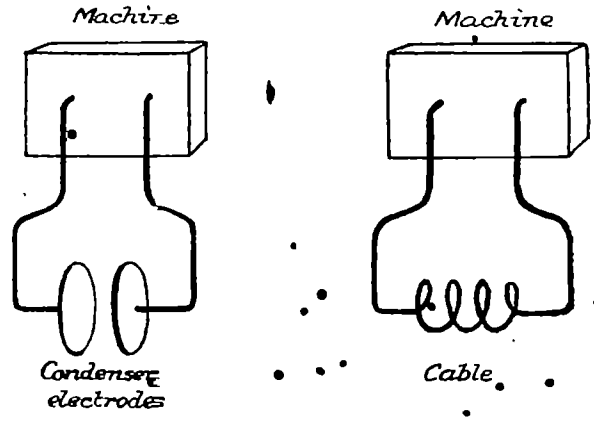
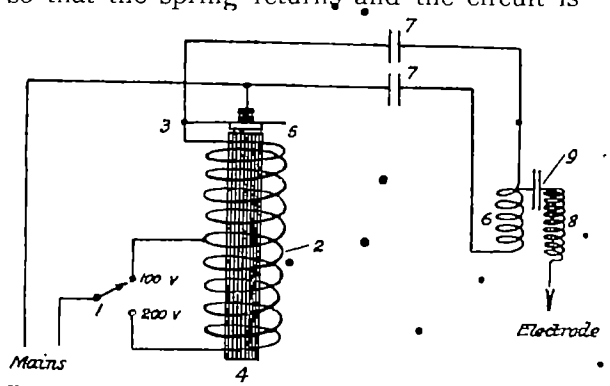


Fig. 148 (left).—Eddy currents produced in conducting material by a magnetic field set up by a coiled cable. The eddy currents are indicated by small arrowed rings.
Fig. 149 (right).—Condenser electrodes and cable connected to short-wave machine.

Many short-wave machines are designed to be used for either condenser electrodes or the cable technique. It will be appreciated that, whereas in the condenser electrode arrangement two leads terminating in some form of condenser plate are used, with the coil arrangement one cable forming a closed electric circuit is used (Fig. 149).

A Low-Power High-Frequency Generator

A simple circuit for a low-power high-frequency generator is shown in Fig. 150. This circuit, used in the apparatus illustrated in Fig. 151, comprises a main induction coil (2) arranged to be supplied through a two-way switch (1) at approximately 100 or 200 volts. In this apparatus, made by Messrs. Electro-Medical Supplies, Ltd., the coil may be supplied with alternating or direct current. The device operates on the familiar principle that, when a current passes through the coil, a magnetic field is set up in the core (4) which attracts an armature on the trembler spring of the contact breaker (5). The attraction of the trembler spring armature opens the contacts, the current ceases to flow and the magnetism of the core is lost, so that the spring returns and the circuit is



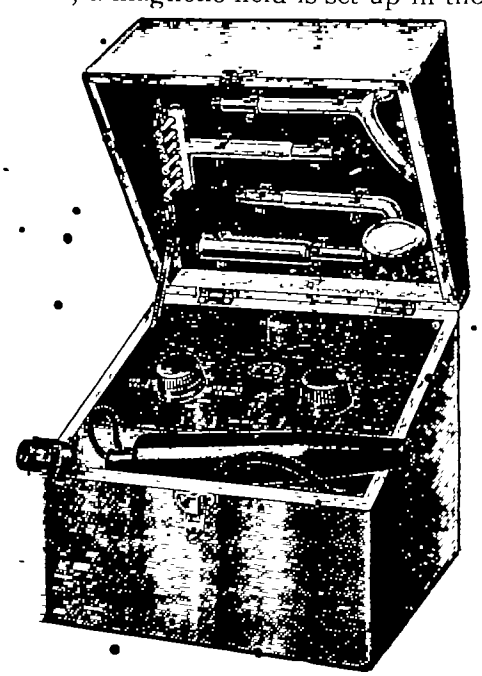


Fig. 150 (above).—Circuit of small high frequency apparatus made by Electro-Medical Supplies, Ltd.
Fig. 151 (right).—Outside view of High-Frequency Generator (Electro-Medical Supplies, Ltd.).

made again at the contact breaker. The high-frequency current resulting from this action passes through the primary winding of the resonator transformer (6) by way of condensers (7) having values between 0.08 and 0.2 microfarads.

Underneath the primary winding is a secondary winding (8) which transforms the voltage up to about 15,000 volts. One end of this is connected to the electrode grip, and the whole is housed in an insulating handle.

A small mica condenser (9) inserted between the primary and secondary windings completely isolates the secondary (patient) circuit from the mains and the arrangement is shock free.

The output may be regulated by adjusting the contact breaker screw; the nearer they are together the greater the output.

A Long-Wave Spark-Diathermy Set

This apparatus, the Thermoset Senior, also a product of Messrs. Electro-Medical Supplies, Ltd., is illustrated in Fig. 152. The diagram of connections is seen in Fig. 153. The Thermoset comprises a main transformer with tappings on the primary to accommodate various supply voltages between 100 and 250. The secondary, wound for 3,000 volts, is connected through the tungsten-faced spark gaps to the oscillator coil, which forms the primary of the high-frequency transformer. Across the main transformer secondary is a condenser forming part of the oscillating circuit. The oscillator coil is of diameter large enough for the resonator coil, i.e., the secondary of the high-frequency transformer, to be mounted within it. This is attached to a handle which permits it to be turned so that the axis of the oscillator and resonator coils may lie either in the same plane, or at 90° to each other. In the latter position, corresponding to the indication " O " on the control handle, no induction is produced in the resonator coil and no current flows in the patient circuit. A smooth control of current output is obtained by varying the relative positions of the coil axes.

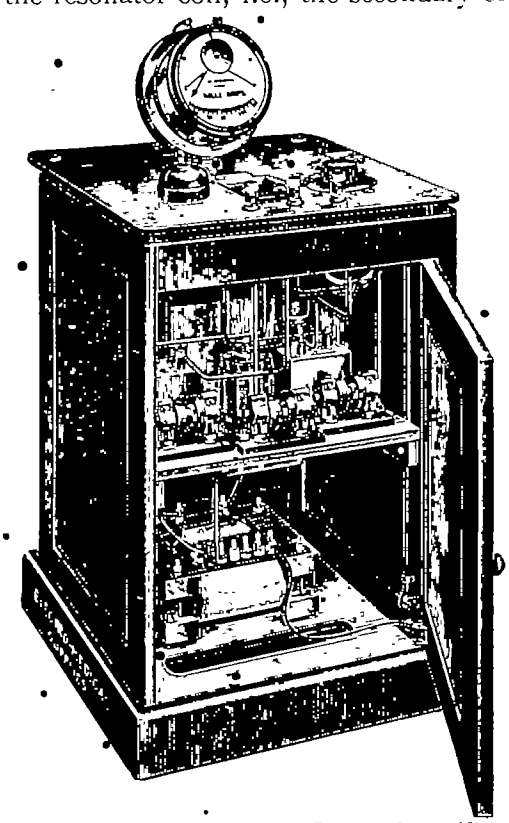


Fig. 152.—The Thermoset Senior Long-Wave Spark-Diathermy Set (Electro-Medical Supplies, Ltd.).

Three output terminals are provided on the control panel. The first (centrally disposed) is connected to one end of the resonator coil; the second and third are connected to the other end of the resonator coil. The second terminal is connected directly and the third through a condenser as shown in the figure. The first and second terminals (i.e., direct connection to the resonator) correspond to " weak currents " up to about 1,500 mA. The introduction of the condenser, by using the first and third terminals, brings the circuit nearer to resonance (tuning at about 450 metres wave-

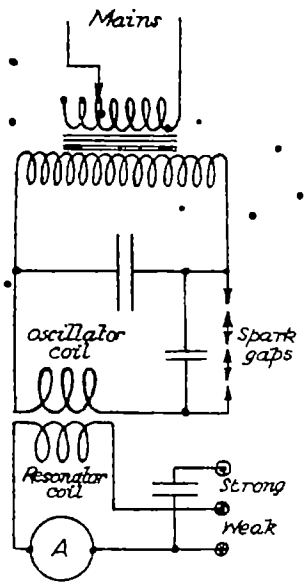


Fig. 153.—Circuit of the Thermoset Senior (Electro-Medical Supplies, Ltd.).

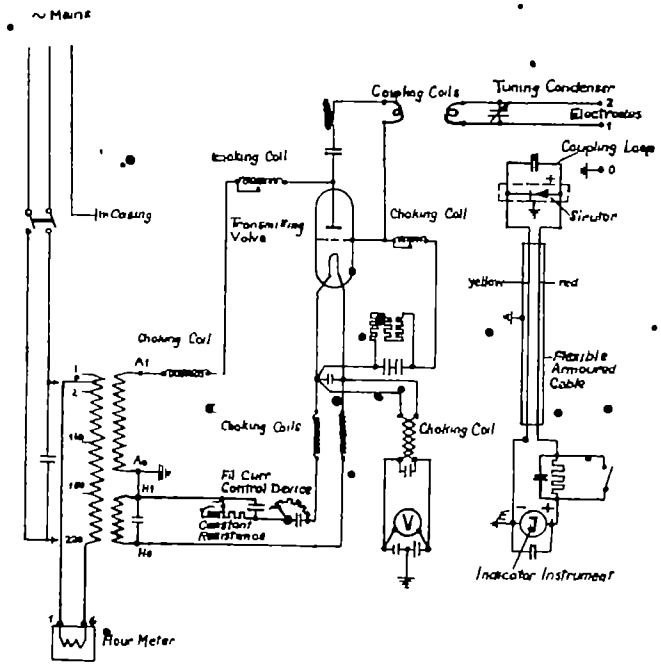


Fig. 154.—Circuit of the "Ultratherm" (General Radiological, Ltd.).

length) and produces the strongest patient currents. The range of the strongest current is up to 4,000 mA.

A smaller model, called the Thermoset Junior, and of lower output (up to 3,000 mA.) is useful for many general treatments. It is available in compact attaché-case form, which is convenient and portable. A milliammeter is provided in the patient circuit of each model.

Messrs. Electro-Medical Supplies, Ltd. also make valve-maintained short-wave apparatus.

An Ultra-Short Wave Machine

An example of modern valve-operated short-wave apparatus is given by the Ultratherm, a Siemens machine marketed by Messrs. General Radiological, Ltd. An outside view of the machine is seen in Fig. 155, while Fig. 154 gives details of the circuit.

The Ultratherm is arranged for a fixed wave-length of 6 metres (50 million cycles per second), the patient circuit being inductively coupled with the oscillator circuit and provided with a variable condenser to permit tuning to the 6-metre wave-length.

The output may be varied by varying the filament voltage (and consequently filament-heating current) of the oscillating valve, the maximum output being 400 watts. As seen in Fig. 154, the circuit comprises a main transformer connected to the mains. This has a number of tappings to enable connections to be made to mains of various voltages. The secondary of this transformer has two parts, the lower part in the diagram for valve filament heating, and the upper part for applying a potential across the anode and filament of the valve. A number of choking coils are provided in these circuits to prevent high-frequency currents reaching the main transformer.

The voltmeter connected across the valve filament is protected from high-frequency currents by a choking coil and parallel condenser. The condenser and coupling coil

connected in series from the anode to the grid of the valve form the oscillating circuit.

The control panel, mounted on top of the apparatus cabinet, is fitted with the following instruments:—

(1) A main control switch for switching apparatus on and off.

(2) A resistance control for regulating the filament volts on the oscillating valve.

(3) A voltmeter for measuring the filament volts on the oscillating valve.

(4) A control for the variable condenser in the patient circuit for tuning to resonance.

(5) A resonance indicator.

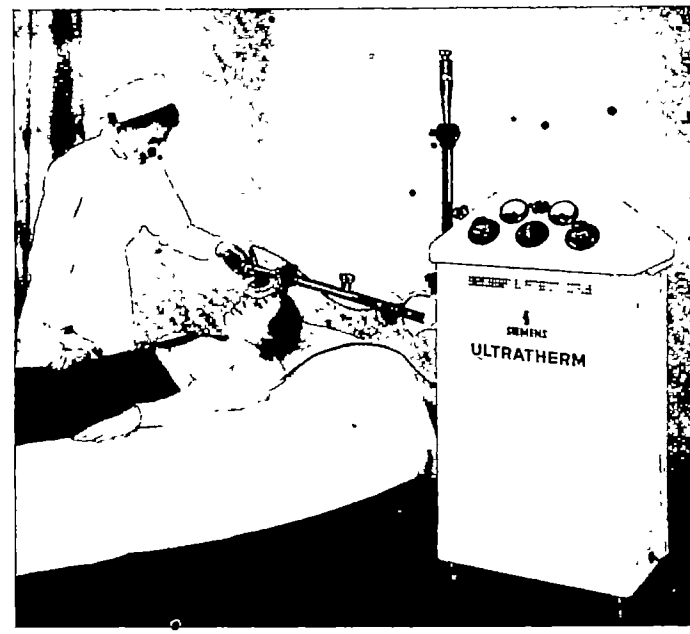


Fig. 155.—Outside view of the "Ultratherm" (General Radiological, Ltd.).

(6) A change-over switch for altering the sensitivity of the resonance indicator.

A mains cable 3 yards long, with a third core for earthing the apparatus, is provided. An operating-time meter is incorporated in the cabinet, which indicates the total number of hours during which the valve has been in use.

The Resonance Indicator (Sirutor).—This is really a wave-meter* comprising an oscillatory circuit with coupling loop and condenser disposed near a part of the patient circuit within the cabinet so that it can pick up waves by induction. The actual indicating instrument is connected across a rectifier in the oscillating circuit with a high resistance in series. The sensitivity of the instrument can be varied by short circuiting this resistance. The reading on the resonance indicator is a maximum when the patient circuit is in tune and this conditon is attained by turning the control handle.

Applications of the Ultratherm

The Ultratherm machine may be used for both condenser and coil-field treatment and also for certain surgical work.

A variety of electrodes is available for condenser-field therapy of various parts of the body, and electrode holders, as seen in Fig. 153, make it possible to apply the electrodes conveniently in any position. Band and flexible plate electrodes may be bound on to the body in the familiar manner.

The Ultratherm is designed for the occasional surgical work of the general practitioner, i.e., for minor operations and certain larger-scale electro-surgical work, but the apparatus is not suited to heavy operating-theatre routine.

Operations are performed using one pole, the proper electrode, either needle, lancet shaped or snare instrument being selected for the specific purpose.

*For notes on wave-length and frequency, see *B.J.P.M.*, 1938, Vol. 1 (New Series), page 317, Sept.

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

Physical Therapy in Arthritis

F. H. Krusen (*New England J. Med.*, 1939, ccxx., 463) discusses the use of heat, massage, manipulation, splints, exercise, postural training and rest in the treatment of arthritis. Rest should be prescribed in definite amounts in chronic infectious arthritis; from 10 hours in bed at night and one hour of rest each morning and afternoon should be enjoined, but this varies with the patient. Heat may be of considerable value, and can be produced by means of the hot bath, the temperature of the water ranging between 98° F. and 105° F. The use of ordinary paraffin as a local application is recommended. A double container should be employed, the outer one being filled with water and the paraffin placed in the inner one. The paraffin should then be heated to melting point and allowed to cool until a thin film has formed on the surface; at this temperature it will be tolerated by the skin and should be painted over the affected joint. U-V-R is of occasional use in chronic arthritis. Massage should not be employed if acute pain on movement of the joint exists. Effleurage may relieve the pain. Exercise is always a necessary part of treatment, and under-water exercises may be of extreme value. The prolonged use of fever therapy is not encouraging, but daily fever therapy of 30 minutes' duration may be valuable. In gonorrhœal arthritis, fever therapy should be combined with the use of sulphanilamide.

Ultra-Violet Irradiation in Gastro-Intestinal Tuberculosis

J. S Coulter and L. L. Hardt (*Arch. Phys. Ther.*, 1939, xx, 143) divided their cases of intestinal tuberculosis associated with pulmonary tuberculosis into eight groups. The cases were under treatment for six months or more. Group 1a were given a high vitamin, high mineral, bland diet and ultra-violet irradiation Group 1b were given the same dietary as Group 1a but no ultra-violet irradiation. Group 2a received 15 gr. of calcium gluconate by mouth half-an-hour before meals, together with the above diet and ultra-violet irradiation. Group 2b received similar treatment without ultra-violet irradiation. Group 3a received 100 c.c. of a 10 per cent. calcium chloride solution intravenously twice a week, plus the above diet and ultra-violet. Group 3b received similar treatment to 3a without ultra-violet. Group 4a received 10 c.c. of a 5 per cent. solution of calcium gluconate intramuscularly two or three time a week plus the above diet and ultra-violet. Group 4b received the same treatment as 4a without ultra-violet. The patients on the bland, high-caloric and high-vitamin diet, with or without calcium, and with ultra-violet irradiation, showed greater improvement than those with the same therapy minus ultra-violet. In many of the cases the improvement in the gastro-intestinal condition exceeded that of the pulmonary tuberculosis. Irradiation decreased the symptoms, or kept them stationary, with or without the calcium therapy. The number of cases thus treated was 315

Pyretotherapy in Wassermann-Fast Syphilis

J. K. Howles (*Arch. Phys. Ther.*, 1939, xx, 149) divided his cases of syphilis with a Wassermann-fast reaction into three groups. The first, comprising 22 cases, showed no changes in the cerebro-spinal fluid. In these chemotherapy and electropyrexia were employed, in 3, or 13.6 per cent. the Wassermann reaction became negative. In the second group of 37 cases, which showed evidence of disease of the central nervous system, the reaction became negative in 9, or 2—3 per cent. The third group contained some patients who showed clinical and serological evidence of syphilis of the central nervous system. No electropyrexia was given in these cases. Three, or 5.7 per cent., of the patients gave a negative reaction after chemotherapy. Electrotherapy is considered to be of value in the treatment of Wassermann-fast syphilis, and, if this treatment be supplemented by chemotherapy, greater benefit accrues. Certain cardiac cases tolerate well the fever treatment, combined with chemotherapy.

Paraffin Bath in Peripheral Vascular Disease

S. H. Sedwitz (*Arch. Phys. Ther.*, 1939, xx, 165) has employed with benefit the paraffin bath in the treatment of peripheral vascular disease.

It stimulates local hyperæmia and reflex vaso-dilatation, and prevents loss of heat by evaporation. He employed the following technique: If the lower limbs were involved the arms were placed in the baths to as far above the elbows as possible, and coated with six to eight layers of paraffin at 110° F. The arms were then wrapped with wax paper and covered with blankets. They were then covered with electric pads in the form of muffs, the temperature being maintained thermostatically at 96° F. to 110° F. When the arms were affected, the same form of treatment was applied to the legs, from the middle of the thigh downwards.

Grenz Rays in Skin Diseases

H. Jungmann (*Brit. J. Dermat and Syph.*, 1939, li, 151) finds the use of Grenz rays to be of value in lupus vulgaris, chronic eczematous affections of the scalp or near the eyes, in Darier's disease, sclerodermia, lupus, pernio, pruritus ani and vulvæ, and sycosis barbae. Owing to their greater safety, they should be used before trying X-rays. Psoriasis and squamous-celled epitheliomata should not be treated by Grenz rays.

Results of Short-Wave Therapy in the Milan Surgical Clinic

L. Mucchi (abstr. *Zentrlbl. f.d.ges. Chir.*, 1939, xiii, 211) reports on his results from the use of short waves during the years 1935 and 1936. Daily treatments of 15 to 20 minutes' duration were given, the wave-length being 6 m. and the tension 350 watts. The heat production in deep parts of the body was measured and found to be slight. Distinct results were found in abscesses and osteo-periostitis, when the patients were treated early; chronic cases were not noticeably influenced. Six out of 8 cases of chronic otitis media were favourably affected. Two out of 12 cases of lung abscess were cured; the chronic cases were only temporarily improved; the remainder were uninfluenced. Pains in chronic inflammation, except after appendicectomy, were eased. Three out of 16 cases of inflammation of the adnexa were cured, eight improved, and the rest were not influenced. Rheumatism in various forms was treated (71 cases). Good results accrued in acute arthritis and in arthritis deformans of the hands and knees, but bad in spondylo-arthrosis. Very good results occurred in trigeminal neuralgia; in other forms of neuralgia, the earlier the treatment the better were the results. With regard to the sequelæ of injuries in active cases (21) healing was quick; in 33 old cases there was no essential result. Three cases of vascular diseases were benefited and also 12 of colitis with constipation. In 8 cases of acute coryza the treatment was ineffective.

Short-Wave Therapy in Lung Abscess

E. Schliephake (*Therap. d. Gegenwart*, 1939, lxxx, 145) corroborates his earlier findings regarding the value of short waves in the treatment of both acute and chronic abscess of the lung. The author briefly describes 4 cases of the former and 4 of the latter, which were cured. By the word chronic, Schliephake means cases not subjected to treatment by short waves before six months. The use of short waves was also curative in abscess following surgical interference such as removal of some ribs. Treatment should be given daily. After the first two or three treatments the patient is often exhausted, but usually sleeps better than before the treatment; this is looked upon as a good sign. No hard and fast rule can be laid down as to dosage. The treatment should be begun with so small a dose that there is hardly any feeling of warmth, and should only last 1 to 3 minutes. If no reaction follows, the strength and the time can be increased. The leucocyte count, the shift to the left and the subjective sensations should be constantly observed. W. Dieker (p. 150) reports on 32 cases of the same condition, which he has treated by the same method. Five of these are excluded, as after 1 to 4 treatments the cases either died or were operated upon. Of these 27, 19 were cured, 3 were markedly improved, 2 showed only temporary improvement and surgical intervention was found necessary, 2 died, and 1 was still under observation. Treatment by short-wave therapy is considered the best treatment available for pulmonary abscess.

Uses of Cold-Quartz Radiation

G. Marchmont-Robinson (*Clin. Med. and Surg.*, 1939, xlvi, 174) uses u-v-r for what he calls "cold-quartz turbinectomy." He irradiates the sinuses over the superior turbinate, then the middle turbinate, turning the applicator through the meatus into the antrum of Highmore and holding it there for 30 seconds. The inferior turbinate is then irradiated by passing the applicator backward until the naso-pharynx is reached; the point is then turned downwards and laterally into the Eustachian tube; irradiation is applied to the turbinate for 10 seconds and then to the sphenoid for 30 seconds. The other side is then irradiated in the same way. General anæsthesia is required. Failures only occurred in patients under 14

years of age. In cases of otitis, the differential diagnosis must first be made. The ear should then be cleansed with dry swabs, then filled with a 1 in 1,000 sodium eosin solution, care being taken to expel the bubble, and the head being held so that the affected ear is uppermost. The applicator should be placed in the fluid and held in place for a minute. Chronic mastoiditis requires several treatments of 30 seconds each, at intervals of 3 to 4 days. In cases of a dry tooth socket, the applicator should be placed in the socket and both sides treated. In streptococcal sore throat, the applicator should be used for three minutes on each side of the uvula. In cases of erysipelas, the author uses the body grid, and irradiates one inch beyond the lesion all round, with the burner 12 inches from the skin and a ten-minute exposure.

General Technique of Ionization

P. Matthieu (*Rev. de physiother.*, 1939, xv, 9) lays down the following principles. (1) Place the current as close to the lesion as possible. (2) Use only feeble currents, 1 to 10 Ma. (3) The treatment should consist of three weeks of rest between each four weeks of treatment. (4) In each series of treatment, give one week of daily treatments (6 treatments) and only three treatments on each of the following weeks. (5) The treatment should not last less than 30 minutes. (6) Weak solutions are preferable to concentrated ones.

Electrical Treatment in Rheumatic Conditions

L. D. Bailey (*Brit. J. Rheumatism*, 1938, i, 117) finds a mild anodal galvanic current is more valuable in acute cases of rheumatic conditions than the production of heat. He recommends a pad of 16 layers of lint soaked in normal saline applied gently over the part and an electrode from the positive pole of the battery in contact with it. Another electrode should be attached to the negative pole opposite the positive one and 5—10 milliampères passed for about ten minutes, given daily, gradually increasing the time at successive treatments to 20 minutes. In acute and chronic fibrositis the faradic current is of value. Surging faradism to the affected muscles should follow, or be given midway between the treatments by heat for 5-10 minutes. In obstinate cases of fibrositis, histamine ionization is often invaluable. The uses of imadyl, doryl and mecholyl are mentioned; their method of application reported and treatment, by diathermy, infra-red and ultra-violet rays discussed.

CORRESPONDENCE

Letters are welcomed on all matters of general interest. Publication does not necessarily imply that the Editors agree with the views expressed.

The Institute of Ray Therapy

To the Editor,
The British Journal of Physical Medicine

Sir,—It always gives me interest and pleasure, as Chairman of the Board of Governors of the Institute of Ray Therapy, to read your valuable *Journal* and so endeavour to keep abreast with modern advances in Physiotherapy, both in this country and abroad. There is, however, in the current issue one omission in your excellent editorial which I feel of sufficient importance to bring to your notice, and for that reason I would ask you to allow me space for this letter in your columns.

You enumerate, after your interesting description of the Phyiotherapy Department of the new Westminster Hospital, certain important clinics also doing Physiotherapy in this country. It was, therefore, I confess, a matter of considerable surprise to me that in this enumeration the name of the Institute of Ray Therapy, the Electrical Treatment Centre in Camden Road, did not appear, and I know you will be glad to repair the omission, the Institute of Ray Therapy now being too well known not to occur immediately to the minds of your readers.

The public who pour through its doors know that it has given nearly one million treatments to its suffering patients since its establishment in 1930, and its President, my friend Lord Horder, on the occasion of the opening of a new extension last year by our gracious Patroness, H.R.H. the Princess Royal, included in his address to her these words: "I have every confidence in saying that this Institute is second to none in this kingdom in its accommodation and in the collection under one roof of such modern and comprehensive apparatus."

I am, yours, etc.,

SEMPILL
Chairman, Board of Governors,
INSTITUTE OF RAY THERAPY.

London, N.W.1.
1st June, 1939.

REVIEWS of BOOKS on Physical Medicine and Allied Subjects

Actinotherapy and Diathermy

Actinotherapy and Diathermy for the Student. By E. B. Clayton, M.B., B.Ch. (Cantab). 182 + viii pp. Illustrated. Price 7s. 6d. London, 1939: Baillière, Tindall & Cox.

This book was prepared from lecture notes, and is intended for students who are studying for the *second part* of the C.S.M.M.G. examination in electrotherapy. In addition, it has helpful notes about short-wave diathermy and inductotherapy—subjects as yet outside the syllabus but likely to be included later.

The following subjects are considered in the first part of the book: heliotherapy; the physics, apparatus and technique of actinotherapy; and infra-red rays and radiant heat.

The author has the gift of excluding non-essential facts without sacrificing clarity of expression or necessary explanation.

In the second part of the book, when dealing with diathermy, it is assumed that the readers "have studied medical electricity in connection with constant sinusoidal and faradic currents before reading this book."

The uses of diathermy and physics apparatus and technique are carefully treated, and the author's wide experience with students is evidenced by his attention to possible errors in technique and means for their prevention.

Though the accounts of short-wave diathermy and inductothermy are short, they add to the book's value.

Print and production are good, but the weight of the volume is to be regretted. Such a useful reference book might, with advantage, have been smaller and lighter to carry about.

M.L.O.

Arthritis, Fibrositis and Gout

Arthritis, Fibrositis and Gout: A Handbook for the General Practitioner. By C. W. Buckley, M.D., F.R.C.P. 154 + viii pp., 14 plates. Price 7s. 6d. London, 1938: H. K. Lewis & Co., Ltd.

This is a scholarly exposition of the present state of knowledge of the rheumatic disorders in all their common manifestations. It is essentially a text-book by a writer with full knowledge of his subject. It is perhaps to be regretted that publication of this book has not been delayed for a time so that it might have incorporated some of the results of the newer work in the rheumatic field, for example, those of X-ray therapy and yet other methods that so far only offer suggestive results. On its own merits, however, it must stand as a book to which every worker in physical medicine should have ready access.

D.P.

Medical Applications of the Short-Wave Current

The Medical Applications of the Short-Wave Current, including a Discussion of its Physical and Technical Aspects. By William Bierman, M.D., and Myron M. Schwarzschild, M.A. XVII + 379 pp.; 60 illus.; 25 plates. Price 22s. 6d. London, 1939: Baillière, Tindall & Cox.

This excellent book is a comprehensive review of short-wave therapy. It will, no doubt, fill the great need we have felt for a standard book of reference on this subject. It is easy to read, and will appeal to the medical practitioner for quick reference as much as to the specialist.

From the short introduction, it is evident that the author is not swayed by enthusiasm, and is writing in the rôle of a critical observer. He believes that the effects of short waves are entirely due to heat, until definite proof is forthcoming for the athermal theory. He reminds us that this therapy, though frequently adequate by itself, must find its place among other accepted measures in medical treatment.

This book is divided into two parts:

(1) FUNDAMENTAL CONSIDERATIONS.—There is a brief history, in which it is interesting to find that the author is a pioneer in this field. He then hands over a chapter of a hundred pages to his physicist to explain the physics of the short-wave current. Mr. Schwarzschild deals with this very difficult task in a simple and practical way. He carries the reader gently from a consideration of the nature of electricity to intricacies of inductance, resonance, impedance and coupling, ending with a description of the generator. An explanation of the heating effect on homogeneous and non-homogeneous substances, and a note on dispersion,

help to show the difficulties encountered in the determination of dosage and treatment in the human body. It is interesting to learn that, in treating the lungs, a pleural effusion will act as a screen, and the current will tend to flow through the fluid and round the lung rather than through the lung tissue. It appears, however, that this screening effect can be overcome by using low wave-lengths.

With the aid of numerous diagrams, the author gives a clear explanation of the distribution of the current by different electrodes. In the section on transfer of energy from apparatus to patient there is a description of wastage. This may completely vitiate a treatment. He ends with explanations of more practical problems, such as measurement of output and heat, wave-length and choice of apparatus.

It is necessarily slow work reading the Physics section, but the author must be congratulated on putting it all so concisely. It is important to study this part of the work, as it has a definite bearing on the proper understanding of the subject.

Dr. Bierman then describes his own work, and that of others, in the determination of temperature changes in the body, and it appears that no appreciable change has been found to result from different wave-lengths, apparatus and technique.

The most interesting chapter in the book is perhaps that on Physiological Responses. Here the author describes what would appear to be all the work that has been done in this connection, as well as his own experiments. The effects on the blood, circulatory, nervous and digestive systems are given, as well as the effect on inflammation, bacteria, cells, tumours, growth and reproduction, and heat regulation. He gives numerous references and conscientiously sets out theories concerning these. Here, as elsewhere, the author stresses the point that all the effects are due to heat. He should emphasize, too, that this heat has hitherto not been available in most instances, except by means of the short-wave current.

He devotes a chapter to the discussion of so-called specificity, and a section—happily a small one—on possible injurious effects.

(2) CLINICAL CONSIDERATIONS.—More than half the book is devoted to this. A very practical chapter on Technique deals very fully with the subject. The descriptions and illustrations of the application of electrodes in various conditions is of great value. He points out, too, that dosage is still unmeasurable, and that different techniques may account for disparity in results. Before turning to the clinical applications, he asks the reader to consider carefully such matters as follow from the technique—such as high and low intensities, and the possibility of injurious effects of too big a dose in some acute inflammations. As he says, he has observed marked aggravation of one abscess in an individual in whom the current had but a short time previously produced a dramatic improvement in another abscess. It was obvious that, although the same intensity was used on both occasions, it was correct for the infection at one stage and too strong for the other, and should have been different on these two occasions.

He then devotes 125 pages to a discussion of the treatment of various clinical conditions. The reader may be a little amazed at the variety mentioned. This is for the sake of completeness and to place all available literature at the reader's disposal. The author comments only on those conditions he has actually treated; for the rest he mentions the sometimes conflicting reports of others. He has taken great pains to describe the results of numerous workers throughout the world. A great feature of the book is the extensive bibliography, which will commend itself to the serious student for speedy reference. It is disappointing that the author cannot add the weight of his own experiences in the description of the treatment of a great number of the diseases. It it hoped, however, that in future editions, which this book richly deserves, the benefit of the author's observations on the outstanding problems will be derived gradually. J.K.

Infra-Red Irradiation

Infra-Red Irradiation. By William Beaumont, M.R.C.S. (Eng.), L.R.C.P. (Lond). Second Edition. XII + 160 pp.; 26 illus. Price 6s. 6d. London, 1939: H. K. Lewis & Co., Ltd.

The second edition of Infra-red Irradiation," by Dr. William Beaumont, has much to recommend it. The author and publishers are to be congratulated on the production of a concise and compact manual. There are chapters on the physiological basis and technique of this therapy, and also a chapter on apparatus. This latter chapter might be somewhat curtailed, since the bulk of the information contained therein can be obtained from instrument-makers' catalogues. Subsequent chapters in-

Concluded on p. 176, col. 2

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THE SOCIETY of PHYSIOTHERAPISTS

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Society of Physiotherapists will be held at the Langham Hotel, London, W.1, on Saturday, 28th October, 1939, at 2.30 p.m. Further particulars of the meeting, together with the audited accounts for the Society's year ending 31st March, 1939, appear in the *Supplement* circulated to members with this issue of the *British Journal of Physical Medicine.*

POST-GRADUATE LECTURES.

A further lecture under the auspices of the Society was given by Dr L. G. H. Sarsfield, M.I.E.E., A.Inst.P., on 14th June, the subject of his lecture being "The Theory of Short Waves." As the subject could not adequately be dealt with in one lecture, Dr. Sarsfield divided it into two parts, and he will give a second lecture on Wednesday, 5th July, at 8 p.m., at the Royal Institute of Public Health and Hygiene, 28, Portland Place, London, W.1. Dr. Sarsfield dealt with "The Theory of Short Waves" in a most lucid and interesting way, and it was apparent from the applause he received that those present had not only benefited by but enjoyed his lecture.

The Executive Committee will be grateful if those members who intend to be present at the lecture on 5th July will advise the Hon. Secretary not later than Monday, 3rd July. Non-member registered physiotherapists are welcome to attend these lectures, the fee being 3s. for both members and non-members of the Society. The lecture on 5th July is to be at 8 p.m., which it is hoped will enable a greater number to be present.

REVIEWS OF BOOKS—*concluded from p. 174.*

clude one on the "Treatment of some Common Symptoms." Since infra-red irradiation is the most potent and pleasing remedy for the relief of pain, this chapter is interesting and enlightening. But the recommendations to use luminous heaters and black-body generators for different diseases appear to be somewhat indiscriminate. Dosages of ten or fifteen minutes, which are frequently advocated, are considered by most authorities on this subject to have but little therapeutic value. Kovacs states, in his third edition of "Electrotherapy and Light Therapy," that "there is no scientific basis for giving treatment with a dark infra-red source for a few minutes as if it were comparable to a powerful source of ultra-violet rays."

A reviewer is apt to be critical, but nevertheless this book should be read by all interested (and which of us is not) in the alleviation of pain and suffering. W.A.T.

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PHYSICAL MEDICINE

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Original articles are invited on any aspect of Physical Treatment. Such articles are published only on the understanding that they are contributed exclusively to this Journal, which does not hold itself responsible for statements made or opinions expressed by any contributor. The copyright of all articles appearing in the Journal is strictly reserved.

The Path to Progress

IN his interesting and stimulating article on page 178 of this issue of the *Journal*, Sir Morton Smart emphasises a point which we have been continuously stressing in these pages, namely, that the progress of physical medicine in this country, and its adoption by the medical profession generally, has by no means kept pace with the great developments in the subject.

He lays the blame for this on the inadequate measures available for the education of the under-graduate and post-graduate, and places the responsibility for the future of physical medicine on the "wisdom or otherwise of those who control medical education and research."

It is an unfortunate fact that physical medicine as such has no definite part in the curriculum of the medical student. Dermatology, Fevers and other special subjects the student must take, and must attempt to master in the knowledge that his examiners will expect him to have a reasonable knowledge of these subjects before qualification. His knowledge of physical medicine, if any, is acquired in bits and pieces in the various departments through which he has to pass. This is not enough. Physical medicine must be studied as an entity in a department properly equipped to give him an insight into the practical application of the various modalities and a reasonable demonstration of how these work, in what disease conditions they are particularly effective, and how the patient reacts to them. At the same time he should be allowed an opportunity of studying a proper co-ordination between the other departments and the physiotherapy department, for physical medicine, while it is worthy of the status of a special subject, has valuable applications in practically every other branch of medicine and surgery. It is a poor argument to say that the student's curriculum is already overcrowded.

While his knowledge of physical medicine should commence in his student days, it should be continued during his post-graduate career. But, even for qualified medical practitioners, there is yet no adequate post-graduate teaching facilities. Even that excellent institution the British Postgraduate Medical School has not yet seen fit to include physical medicine in its syllabus.

Finally, with regard to the control of physical medicine and the co-ordination of physical and physiological research with clinical trial, there is no official body to undertake this. It is true that there are the Physical Medicine Section of the Royal Society of Medicine and the Physical Medicine Group of the British Medical Association, but these are academic, rather than practical bodies. At the Annual Meeting of the British Medical Association, which takes place this month at Aberdeen, physical medicine is not represented in the discussions.

The only logical solution appears to be the establishment of a real Society of Physical Medicine to look after the interests of physical medicine generally, to co-ordinate knowledge on this subject, and to propagate it among the medical profession. No doubt this will come in time but, in view of the rapid advances being made in the subject and the necessity of evaluating each new addition to knowledge, it appears to us that it is overdue. There are, of course, difficulties in the way, and the founding of such a Society requires initiative and industry, but pioneering is surely exciting and stimulating work. May we hope that some of the more active members of the medical profession who have the advancement of physiotherapy at heart will give this matter their serious consideration in the near future.

PHYSICAL MEDICINE AND INDUSTRY*

By SIR MORTON SMART, K.C.V.O., D.S.O., M.D.
Manipulative Surgeon to H.M. the King.

PHYSICAL medicine, or physical therapy, is a term which may be defined as the treatment of disease and injury by various physical means, and, broadly speaking, it comprises the use of electricity, heat, hydrotherapy, massage, therapeutic exercises, radiant energy naturally or artificially produced, mechanical measures such as negative and positive pressure machines, occupational therapy, and manipulative surgery.

Particularly where the treatment by various electrical methods is concerned, the most remarkable and the most rapid advances probably have been made in the last few years, and this in spite of the threat to its ethical standing with the medical profession, which from time to time has interfered with progress and the good relationship which *should* exist between physical medicine and all other branches of medical science. Many examples could be given of the harm done to the status of physical medicine during its long history of over 200 years. Throughout all its history, probably most harm has been done by over-enthusiastic claims for the various physical therapy equipments, and the indiscriminate use of physical methods for varied conditions without due regard to their true therapeutic value, as proved by competent clinical experience and laboratory research. To-day, it may truthfully be said that physical medicine has at last taken its true position in modern medicine in relation to the usual surgical and medical procedures, and more and more the choice of the various methods of treatment is becoming based on their known therapeutic value, rather than on mere empiricism.

But, in spite of the rapid progress made in recent years, the advantages of the various electrical methods at our disposal are still greatly under-estimated, and much has yet to be done towards placing physical methods of treatment, and particularly electrical treatment, on a well-controlled and scientific basis. In a paper read before the Physical Medicine Section of the British Medical Association in 1936, Professor W. J. Turrell summed up the position so clearly that I make no apology for quoting his statement which appears to be as true to-day as it was then. He said:

> "It is a most remarkable fact, that among the many and varied agents employed in combating disease, the most powerful, the most easily regulated and controlled, the most fundamental in its action and the most universally called for, is almost entirely neglected by the medical profession."

Electricity is steadily invading every aspect of our daily life, but, so far as concerns the human body, every phase of the activity of which has an electrical basis, its action and application are almost entirely overlooked. It can confidently be asserted that no other form of treatment has a more definite physiological basis, or requires for its efficient administration a more intimate and extensive knowledge of the fundamental principles of the vital forces, both in health and disease. If we wish to apply electrical treatment in a scientific manner, and with its maximal therapeutic effect, we must do so in regard to this fundamental action, rather than administer it in a purely empirical manner, merely asserting that such and such a treatment is good for such and such a disease.

It is now an accredited fact that physical medicine, and particularly electrical treatment, has passed from the transitional stage, and is to-day firmly established as

*A paper read at the Congress of the Royal Institute of Public Health, at Hastings, May, 1939.

a recognized branch of medical practice. It is no longer always merely an adjunct to other medical or surgical procedures, but is frequently, as a method of treatment, the main line of attack, and *other* medical agents or surgical procedures become the secondary line of attack.

Because of the great increase in our knowledge, both from the physiological and therapeutic aspects, physical medicine has become so vast a subject that no one, unless able to give the time to specialize in its many ramifications, is ever likely to weigh up fairly all its therapeutic values. Much of the undeserved disrepute which has been associated with electrical treatment particularly, has been primarily due to lack of understanding and knowledge of its physiological effects. Those who have adequately and intelligently studied the subject are the first to concede that treatment of injury and disease by electrical methods, is, like many other methods, not infallible, but this is no reason why, as is so frequently the case, patients should be advised to try "electrical treatment" when the condition under *other* treatments has advanced to such a state that little hope of ultimate recovery can be entertained.

Early treatment, by whatever method adopted, will surely be conceded by all to be of immense importance with regard to expected results in the treatment of all disease and injuries.

Knowledge of the physiological effects of electricity is of such vast importance that it would seem hardly necessary to emphasize that indiscriminate treatment of diseased and injured tissues by electrical means, and by those who have not the necessary knowledge, is only likely in the end to bring the method into disrepute.

The tendency to-day for physicians, who are not trained in electrical methods of treatment and other physical agencies, to send their patients to members of the Chartered Society for treatment, unaccompanied by specific detailed instructions, does not necessarily act in the best interests of either the patient or the practitioner. Even if he had the special knowledge, a busy practitioner has little time to give to the necessary supervision, with the result that, except in very exceptional cases, the patient drifts into a stage of over-treatment without progress, or gives up before he should, because he feels little benefit to compensate him for the time required for the treatment.

There are great difficulties lying in the path of workers in physical medicine, and there are certain essentials necessary before it will be possible to place physical medicine on the sure foundation of an exact science.

These essentials may briefly be cited as follows:

1. Recognition of physical medicine as a definite and important branch of medicine. This can only be achieved by physical medicine being wholly controlled by competent medical practitioners with adequate special training.
2. Abolition of empiricism as far as possible. Empiricism can only be dispelled by the scientific investigation of the various physical agencies used.
3. Efficient control of physical medicine. The study of physical therapy is intricate and complicated, and involves considerable inroads into the time and fina[redacted]ces of the investigators, and at present is not under sufficient con[redacted]he best results. It is because of the lack of sufficient scientific [redacted] the physical, physiological, and biochemical aspects, that a [redacted]ns wherever physicists and medical men meet to discuss [redacted]ds. To obtain the best results in research, such as [redacted]l man with *wide clinical experience must*

[redacted] prescribing physical methods of treat[redacted]hould only be prescribed after careful

the treatment of all disease by whatever agency—be it by drugs, surgery, or physical agents—should be *primarily under the guidance and control of fully qualified practitioners*. But it does not upset this principle, to agree, that, particularly where physical agencies in treatment are concerned, there is need for auxiliary workers qualified by examination in this branch of medicine. Such assistants are obviously necessary and valuable when competently trained to carry out the mechanical details necessary, during the administration of physical therapy, under medical supervision.

5. Adequate education in the principles of the methods employed. To obtain the required competency in the use of physical agencies, *the means of education must be adequate*. The main source of education to-day, is through Medical Societies and various Journals. Although great benefit has accrued from these sources, particularly from certain journals, this is not nearly enough. Education, to attain the value that is necessary, must proceed through the medium of Undergraduate Schools and Post-Graduate Teaching.

The future of Physical Medicine would appear to be greatly dependent on the wisdom or otherwise of those who control medical education and research. But, whatever the future in this respect may be, *nothing can prevent the steady advance of physical medicine as one of the main lines of defence against the inroads of disease.*

Let it be conceded that physical methods of treatment have to-day reached such a state of importance, that there is an increasing demand for them. Who are the people most likely to obtain the benefits from such treatment? Owing to the great cost of apparatus and the large space required for it, it is obvious that, so far as private practice is concerned, such treatment must of necessity be largely confined to the wealthier classes. Those unable to afford the advantages of private practice have recourse to the special departments of hospitals, but unfortunately the benefit of treatment is to a large extent negatived because of the many and varied difficulties with which such hospital departments are faced, the chief of these being the constantly increasing numbers which demand electrical and other methods of physical treatment.

I can foresee the day not far distant when the advances in physical medicine will be of such a character that treatment by physical methods will not be confined to the wealthy classes only, but that it will become the expected *right* of every insured worker in the country *to demand* treatment by these modern methods. It is for the industrial workers of all classes that I make my plea to-day, that the workers in the sphere of physical medicine should organize themselves and combine their efforts to evolve a practical scheme which will finally educate the workers themselves to realize that there is more to be expected for the money they pay in insurance, than the mere giving of a bottle of medicine—a principle of treatment which is being encouraged and perpetuated by the workings of the Insurance Act itself, and which is, frankly, detrimental to the status of medicine.

At the same time, much praiseworthy work has been accomp[illegible]ehalf of the panel patient by municipal authorities and voluntary organi[illegible] clinics for treatment by physical therapy, but whatever suc[illegible] has *not* been due to encouragement from the central s[illegible]

Under present conditions a panel pati[illegible] muscle stiffness usually neglects the co[illegible] doctor, and the most the latter can do [illegible] ointment to be rubbed in, in spite of [illegible]

institution happens to exist in his district, and this is extremely unlikely.

I cannot conceive that anyone will dispute the right of workers to have the latest scientific methods of treatment provided for them, so that they may obtain their benefits, not only in cases of advanced and serious disease, but also in many of the less serious cases of minor injuries and early rheumatic affections of joints and muscles, which become so fruitful a source of serious incapacity and loss of working hours, if not adequately treated in the early stages. Their claim can be based on the dictates of humanity alone, as well as upon the vast sums spent annually in insurance premiums and sick benefits, to a large proportion of which the workers themselves contribute.

If, then, it is agreed that a case can be made out that the industrial workers have a *right* to claim that suitable treatment by physical methods should be provided for them, the question naturally arises, "How should the problem be approached?" The obvious solution would at first sight appear to be for the experts in physical medicine to call the immediate attention of the Government to this burning question, and to press for action; but in that direction I fear the difficulties would be, particularly in the early stages, almost insurmountable, and delay and postponement would probably play havoc with the patience of those trying to further any such scheme. If, however, a comprehensive scheme for the formation of Industrial Clinics were worked out, and then the Government were approached to consider it, much of the initial delay inevitably associated with a Government Department might be avoided.

That the matter is urgent is evident from the fact that treatment by physical methods has now become a general necessity in the fight against disease, and, in its proper place, *physical medicine is the most efficient method of treatment against the ravages of many of the most disabling industrial diseases and the results of injury.* Secondly, there is urgency for the formation of a complete national scheme at the earliest possible moment, because the establishment of Physical Medicine Treatment Centres by municipal authorities and voluntary organizations, may, if they become numerous, defeat their own end by causing confusion and wasteful overlapping, because of the absence of the necessary control and co-ordination which is essential to the effective working of a national scheme. The question is rapidly becoming a national problem, and it is more than time that this truth should be realized by the Government, and an appropriate national scheme brought into being.

The much harassed medical practitioner, with many panel patients for whom he would like to prescribe physical therapy, only too clearly realizes the difficulty of administering certain desirable methods of treatment, *except in properly equipped institutions*, and recognizes that the average general practitioner cannot ever hope himself to give his patients more than the very simplest forms of electrical treatment, and in the majority of cases even this is impossible.

The modern complete and ideal physical treatment institutes, such as I visualize as an industrial necessity of the future, would be equipped to give every possible form of physical treatment, comprising treatment by light, heat, massage, therapeutic exercises, hydrotherapy, electricity in the form of galvanic, faradic, sinusoidal and high-frequency currents and all forms of diathermy, mechanical measures, such as pressure and suction machines, occupational therapy, and manipulative surgery. Such Institutes would provide a centre for treatment in every industrial district, and they would give manifold opportunities to general practitioners, specialists, and research workers, in assisting in the work, and increasing their experience in physical medicine to the benefit of the community generally.

They would provide an active field for trained technicians, and, if equipped with suitable research laboratories, much valuable data would become available to help in the much needed elucidation of the many difficult and perplexing problems that

surround the subject. It is my conviction that the future of physical medicine lies in institutional treatment Centres, in spite of the initial cost, because, without such institutions, it is impossible to cater for the thousands of workers who are to-day left in a state of complete or partial inefficiency, owing to the absence of facilities for the requisite treatment.

Maintenance of a disabled worker for short or long periods, does nothing to restore him to work, so the immense saving in money which would normally accrue from being able to return a man to his work at the earliest possible moment would be considerable. In addition, the opportunity for adequate treatment for restoration of function as soon as possible, would lessen the likelihood of a worker acquiring a permanent disability, and thus, an industrial man-power loss, and much of the expenditure required to compensate him, would be saved.

Medical practice in this country is mainly on an individual basis, but in the sphere of physical medicine, and particularly as regards electro-therapy, specialization and institutional treatment seems to be inevitable in the future, mainly because of the high cost of adequate apparatus, and the time which is necessary for the individual treatment, if success from the treatment is to be assured. It will be necessary to have whole-time medical men with special knowledge to order and supervise the treatments, and to have qualified technical assistants to administer the treatments under their guidance. By such an arrangement, the cost per head will easily be reduced to a fraction of the cost that is inevitable in private practice, and efficiency of the treatments will be greatly enhanced.

No matter how expensively or how well equipped a clinic may be, it is only by adequate supervision by those versed in the principles and correct application of physiotherapeutic methods that success can be assured.

With the financial strain that besets the Government to-day, it is hardly to be expected that a comprehensive national scheme, such as outlined, could be entertained at the present moment. This, however, is no reason why we should stand still.

I suggest that, as an alternative plan, it would be possible to work out details of a less ambitious, but none the less important, scheme with a view to enlisting the sympathy and co-operation of industrial companies, in the formation and organization of local clinics for their own workmen. These clinics would be on a much less pretentious scale, and would be confined mainly to treatment by electrotherapy, massage, and manipulative surgery. Such a scheme, if effectively carried out, would produce much valuable information, and if success were achieved, as I am certain it would be, such clinics would ultimately act as the nucleus for the more important national scheme to be developed when times are propitious.

Some months ago, Dr. Copeman and I met the Medical Co[redacted] the House of Commons, in conjunction with some of the Miners' Parliame[redacted]esentatives, and several other meetings have taken place since at which th[redacted] of this proposal was fully discussed and sympathetically received. As a di[redacted]t, the matter is receiving the close attention of the Miners' Welfare Association, and it is hoped that some concrete action may result in the near future.

As an initial effort I have tried to persuade the Miners' Representatives to encourage the formation of a clinic at a pithead as an experiment, as I feel convinced that such an effort would be so successful that it would very soon justify the original cost and the annual running expenses.

I should imagine that it would be unlikely that there would be any serious medical objection, either in principle or in practice, to the setting up of local clinics such as visualized, but that rather such a scheme would be welcomed in medical circles.

Such clinics would be of great assistance to local medical men, as they would give them a means of dealing with a type of case which *is present* in all communities in large numbers, and which admittedly cannot be adequately treated by the means

at the command of a panel doctor. If more serious, or if recovery is prolonged, the case is usually referred to hospital, but generally only after much valuable time has been lost.

Associating local clinics with pithead baths or, at some locality near the pithead, would appear to me to be ideal, because of practical advantages in the way of convenience to the workmen, cheap supplies of hot water and electricity, and possibly financial support from the revenue of the pithead baths.

Clinics situated near where large numbers of men are likely to gather together will be an encouragement for men to have treatment without giving up work for more or less trifling complaints, which, otherwise, they would be inclined to neglect, and thus early treatment with its enormous advantages would be achieved in a large proportion of cases.

The question of the cost of establishing a clinic in full working order, capable of handling a minimum of 250 treatments per week, can only be decided by consideration of every detail in conjunction with local conditions. Cost, however, is inevitable, and must be faced, but, in a properly worked out scheme, it should be possible to keep the cost down to a minimum compatible with producing an efficient establishment. The same applies to the annual cost of running the clinic, and I have such confidence in the success of the scheme that I unhesitatingly believe that an experimental clinic at a pithead, would prove by its results that almost any cost within reason would be a good insurance against economic loss from man-power wastage.

The clinic, apart from the question of medical supervision, would be conducted by members of the Chartered Society who hold their diploma.

The number of the staff would depend upon the designed capacity of the clinic. A minimum of assistants for a clinic with a capacity for 250-300 treatments per week would be four, with a Secretary Almoner who would also hold the Society's diploma. *Medical supervision would be essential.* A clinic of this capacity could, I think, be efficiently run at an annual cost of not more than £2,500 to £3,000.

A certain proportion of this cost could be recovered by a small charge for treatment, and possibly financial assistance could be arranged with Insurance Companies, who would benefit considerably by the direct result of early treatment enabling the men to return to duty much more quickly than when treated under less advantageous circumstances.

By the courtesy of the President General of the Utica Mutual Insurance Company of Utica, U.S.A., I have received some general information on the subject of the physiotherapy department which this Insurance Company conducts in its own Hospital. This has been in existence for 15 years, and during that time it has had many thousands of cases under treatment. The department is supplied with all types of diathermy, whirlpool baths, infra-red and ultra-violet lamps, and equipment for exercise and rehabilitation. The point is also stressed that the whole is under the constant supervision of a physician thoroughly familiar with these types of therapy.

Dr. Locke, who is the chief surgeon, in a report to me states that a very large majority of the cases they treat by physiotherapy, are benefited. He also states that many patients who have been claiming compensation, and even many who have had a schedule loss already awarded, have, at the request of the Department, had their final examination postponed for a period of two to six months, and, as the result of treatment, the schedule loss has been materially reduced, and in many cases passed with no permanent disability.

The following quotation is from Dr. Locke's report:

> "There is no question from our experience that the period of disability in a large majority of cases has been lessened. We believe that the advantages of physiotherapy are not only in lessening the period of disability, but also in aiding us to have the patient under our close observation, and in encouraging him to return to his own, or some other occupation."

Having now established our clinic, it may be profitable briefly to consider the types of cases which I consider could be advantageously treated, and it is my considered opinion from long experience that many of the late disastrous effects in some of the types enumerated, will be prevented by the establishment of local industrial clinics.

In the following groups I shall describe briefly the type of case I have in mind, many of which are neglected by the patient himself, either through ignorance, or from lack of opportunity for correct treatment; many undergo inadequate treatment, inseparable from existing conditions; and all could be treated by local clinics with great advantage.

Group 1.

Minor strains of muscles, ligaments, and other joint structures, not necessitating giving up work.

Group 2.

More serious strains of muscles, and sprains of other joint structures, generally necessitating diminished working capacity, partially or wholly. All types in these two groups, if neglected, frequently lead to serious disability, and the key-note to success in their treatment, is to take them in hand early before secondary changes supervene.

Group 3.

Is a large group comprising cases of atonic and wasted muscles, following early arthritic changes, and after injuries of varying degree, including the after-effects of dislocations and fractures. This is a group of paramount importance.

The importance of the early treatment of atonic and wasted muscles, as I emphasized in my Presidential Address to this Meeting last year, cannot be overstated.

Atonicity of muscles, leading to wasting, is a slow and insidious condition, which follows inflammation of tissues from any cause, and non-recovery leads inevitably to loss of function and crippling of all degrees. Later, joint changes supervene from wrong mechanical stresses, caused by inefficient muscular action, and from the diminution of the arterial, venous, and lymphatic circulations, resulting from the lessened pumping action of the wasted muscles. I cannot emphasize too strongly the importance of the *early* treatment of the cases involving strains, sprains of ligaments, and other joint structures, and atonic and wasted muscles following early arthritis and injury.

Such cases are to be seen every day in large numbers, and are a most fruitful source of serious arthritic changes in the later stages, and I have no hesitation in saying that much disability and loss of working hours *could* be prevented by adequate *early* treatment of cases in these three groups.

Further, the treatment of these cases by a particular electrical method is the only method I know which is uniformly successful in its results, and, if given in the early stages, prevents the formation of adhesions which lead to pain and crippling out of all proportion to the original damage to the various joint structures.

It is mainly on account of my conviction, from a long experience of the treatment of such cases, that many of the late disastrous effects can be prevented by early and adequate treatment, that I so strongly support the proposal for local industrial clinics.

Group 4.

Consists of types of cases which, for convenience, may be described under the terms " chronic rheumatism " and " fibrositis."

The work of the Empire Rheumatism Council has emphasized that rheumatism more seriously affects the economic life of the community than any other disease

condition, and chronic rheumatism by itself is annually responsible for great havoc and economic loss among workers of all classes.

As treatment by physical medicine has proved conclusively that it can offer the most valuable assistance in all manifestations of chronic rheumatism, and as official statistics show that one-sixth of the total payments made under National Health Insurance is directly due to rheumatism, it is surely no exaggeration to claim that facilities for well-organized treatment by physiotherapeutic methods would be a valuable contribution to the desirable efforts to reduce this serious wastage of man power. Further, the provision of organized facilities for industrial workers to obtain these benefits, particularly in the early stages when the disease is most amenable to treatment, is surely a claim which the workers have a right to expect, in view of their own large contribution to the Insurance Fund.

Insurance Companies also must realize that their duty to employer and employee does not cease with the provision of ordinary medical relief, and payment of compensation. It must therefore be possible to interest Insurance Companies in any scheme which is likely to lead to a reduction of long-standing disability, which is an enormous and unnecessary drain on their resources.

It is not my intention to quote largely from statistics, but the following quotation from the *British Journal of Physical Medicine,* is sufficient to give one some idea of the magnitude of the question at issue. (In passing I should like to acknowledge with gratitude the help the Editor of the *British Journal of Physical Medicine* has given me in supplying information from his files for the preparation of this paper.)

The quotation which refers to one year only is as follows:

> "The sum of £20,000,000 was paid out in Insurance Benefit representing 34,000,000 weeks of incapacity. Five-and-a-half million weeks, costing £3,000,000 were due to rheumatism or allied diseases. Adding the loss of wages estimated at £12,000,000, it is found that the economic loss caused by these diseases reached the huge total in one year of £17,000,000. The sums paid by Insurance Committees for Salicylates and Alkalis must be enormous, and out of all proportion to the benefits received, since a radical cure demands much more than the relief these drugs can afford. The conclusion to which all leading medical men are being driven is that physical therapeutics offer the only effective means of reducing the enormous loss, and lessening the physical and mental suffering due to these diseases."

Fibrositis is a common condition, and one which is particularly amenable to early treatment, but which, if neglected, may ultimately have serious consequences. Fibrositis is characterized by an acute and chronic inflammation of connective tissue, and affects the fibrous supporting structures of muscles, fasciæ, joint capsules, tendons and their sheaths, and particularly the *areolar tissue* of any of these structures. It is important because of its crippling effect from pain in the acute stage, limitation of movements from adhesions in the chronic stage, and the loss of the resiliency and pliability of various structures in the pre-adherent stage. Lumbago, sciatica, intercostal and muscular rheumatism, may be instances of fibrositis with special names, denoting rather the locality affected than the actual pathological changes descriptive of the condition. Mild trauma is often a contributory cause, and treatment in the early stages is important, and frequently prevents more serious results which follow neglect.

Group 5.

Certain stages of osteoarthritis, particularly in the early stage when the disease is more or less confined to the periarticular structures—a condition which is so common and often the forerunner of serious bone changes.

In the early stages the symptoms of periarticular arthritis are generally not considered by the average working-class patient serious enough to warrant special treatment until sleep is disturbed, but it is a condition leading to late damage to joints, and in the early stages is most amenable to physical treatment.

Group 6.

Adhesions. Two of the most prolific causes of persistent discomfort and dysfunction in muscles and joints are the formation of adhesions, and the malnutrition and stretching of the areolar tissue, due to interstitial oedema, leading to loss of its normal flexibility and suppleness, and characterized by a feeling of muscular and joint stiffness. In such cases the normal free action of the muscles is interfered with, and the condition is the direct result of imperfect repair after inflammation from any cause.

From the facts that inflammation causes adhesions, and that inflammation is present in *all* cases of injury and disease, it will be realized that adhesions and their grave consequences in limiting the movements of parts upon each other, are extremely common and of serious moment, because of their interference with the body mechanics generally. Pain is an invariable accompaniment of adhesions, and thus is a further cause of joint disability. A point of importance in considering the seriousness of adhesions in relation to treatment is that it is all too common for cases of joint and muscle adhesions to be labelled "rheumatism," particularly by the patient himself and his relations, and in consequence they are frequently wrongly treated and do not recover. This is all the more disappointing in view of the fact that, in the vast majority of cases of interference with joint action by adhesions, correct treatment will end in complete cure, whereas if treated as rheumatism much valuable time is lost, and the adhesions bind parts more and more powerfully together as time marches on, and so the difficulty of treatment is increased.

Mainly owing to the fact that in the early stages the conditions produced by adhesions do not appear to be serious enough to warrant the patient seeking advice, the muscles waste, and thus further crippling of the joint occurs.

The condition thus described constitutes an enormous group in every community, and particularly in a working-class community, and inevitably leads to varying degrees of disability, and later to the more serious arthritic changes, so that industrially this group is of the greatest importance. Fortunately, most cases in this group are most amenable to treatment if diagnosed and correctly treated early, and in my opinion they are so important from the arthritic or chronic rheumatic point of view, *as almost to warrant the formation of local clinics for their treatment alone.* It is in these cases that manipulative surgery and treatment of the muscles by graduated contractions are the most successful forms of treatment.

It may now be interesting briefly to record what usually happens to the cases in these groups.

In Group 1, comprising slight strains and sprains, the patient usually does nothing, and, owing to the dormant energy for repair which lies within the body cells, many such cases recover completely. Others less fortunate drift into Group 2.

In Group 2. Nothing more than ordinary home remedies are applied, and a certain number of cases recover for the same reason as in Group 1. But a large number do not recover, and proceed to develop a more serious condition, expressed generally by increase of pain, swelling, and loss of function. Groups 3, 4, 5, and 6 usually end up by seeking specialized treatment at a hospital. But hospitals are faced with the difficulties of dealing with large numbers of the more serious cases, so that adequate time for the proper treatment of the types of case under review becomes almost impossible, even if there happens to be available a physiotherapeutic department. The consequences are:

1. That there is much wastage of time due to the patient having to wait long hours for his turn for treatment.
2. That too little time can be spared to give adequate treatment at each visit.

3. That further loss of time is caused by the necessity of ordering treatment twice or three times a week only, in the hope of spreading out the capacity of a busy department. Treatments twice and three times weekly, and treatments reduced in time at each visit, are in the majority of cases practically useless.

Supervision of cases under treatment is for many reasons in my opinion absolutely essential in the interests of the patient, and I wish to stress the point most emphatically that *adequate* supervision is one of the most important and necessary factors leading to successful results of treatment by *all* methods which come within the sphere of physical medicine.

Again I would like to emphasize the point that physical treatment in the early stages of minor injuries and arthritis would not only enable a man to return to effective work quickly, but it would undoubtedly lessen the tendency to more serious late developments.

Finally, it is my considered belief that only by the establishment of properly supervised industrial clinics in various centres will the workers and industrial managements receive an adequate return for the contributions they make annually towards medical aid.

THE CLINICAL APPLICATIONS OF MASSAGE

By JAMES H. CYRIAX, M.D., M.R.C.S.

THE way in which massage works is not properly understood. In order to form a definitive basis for research the two great necessities are (*a*) agreement on what structures respond to massage; and (*b*) the standardization of its technique so that all the conditions amenable to massage are regularly relieved.

STRUCTURES AMENABLE TO MASSAGE

The tissues that I have found to respond to massage are muscle (striated and unstriated), ligament (including joint-capsule), tendon and tendon-sheath, subcutaneous fascia, periosteum, and skin, in order of diminishing importance. The skin, of course, is always affected by any type of massage and may, indeed, be rather a hindrance to the adequate massage of the structures beneath it; but, as I know of no skin disease that massage benefits, and as it is pointless to massage the skin alone for deeper troubles, massage of the skin will not be referred to again.

Muscle

Rheumatism occurs in almost any muscle, but I have yet to meet it in those of the hands, feet, face and larynx. On the other hand, injuries to the small muscles of the hands and feet are not uncommon; the sudden pain in the foot often called Morton's metatarsalgia is caused by overstretching of an interosseous muscle. Rheumatism has a predilection for the central parts of the body, attacking especially the whole length of the erector spinæ, the trapezius, the rhomboids, the levator anguli scapulæ and the muscles about the shoulder and hip joints. Muscular trouble distal to the shoulder and buttock is more often due to injury or overuse than to rheumatism. The treatment is deep friction to the muscle. Owing to the patient's poor ability to localize the painful spot in muscular conditions, it is often necessary to ascertain by selective local anæsthesia, the site of the causative place. When the correct place is infiltrated the pain disappears for the duration of the anæsthesia

(sometimes for longer), and an exact regional diagnosis has been made. This is also a useful therapeutic method, particularly in lesions of those muscles that the finger cannot reach.

Ligaments

The interspinous and lumbo-sacral (with its sacral prolongation) ligaments are the only ones subject to both rheumatic and traumatic inflammation. Traumatic inflammation, with subsequent scarring, occurs in the medial collateral and coronary ligaments of the knee, the fibular collateral ligament of the ankle, and any of the small ligaments of the wrist.

When the medial collateral ligament is causing stiffness of the knee, the skiagram will show early osteoarthritis, but the other—symptomless—knee will throw a similar shadow. Massage to the ligament followed by mobilization of the knee will give relief in about eight sessions; it is no good treating the patient for osteoarthritis. If the coronary ligament is sprained, the site of the tenderness is identical with that due to a torn meniscus, but treatment by massage and mobilization affords permanent relief. Most of the cures of a "torn cartilage" by bonesetters are of this sort. When the ankle is sprained a double injury occurs, namely, to the fibular collateral ligament and to the capsule of the calcaneo-cuboid joint; hence the massage must be applied to the lower edge of the fibula and to the joint-line further in front. Occasionally the one injury occurs without the other. The usual manipulation stretches both structures.

At the wrist, massage is effective without mobilization, but afterwards there is always a fair amount of pain and swelling against which the patient should be warned.

Capsule

In traumatic arthritis of the cuneo-first-metatarsal and first-metatarso-phalangeal joint, massage to the capsule soon gives full relief. Even in osteoarthritis relief lasting a long time may result. Traumatic adhesions in the calcaneo-cuboid joint have been dealt with above. After a finger-joint has been sprained, spontaneous cure takes about a year; this period can be greatly shortened by massage to the damaged part of the capsule. The only other joint the capsule of which occasionally requires massage is the knee.

Tendon

Tendons are particularly liable to inflammation after overuse; the only one which, in my experience, is affected by rheumatism is the epicranial aponeurosis. In the upper limb, the tendons that commonly need massage are the supraspinatus and subscapularis at their insertion into the tuberosities of the humerus, the long tendon of the biceps in the groove, and the tendon of insertion at the elbow. The so-called tennis and golfers' elbows are sprains of the conjoined tendons at the lateral and medial epicondyles respectively; the lesion at the lateral epicondyle is often curable by manipulation alone, whereas at the medial epicondyle massage gives relief, but mobilization does not. Perhaps the commonest site of teno-vaginitis is the extensor and abductor tendons of the thumb where they wind round the shaft of the radius. Occasionally so severe a case occurs that the tendon is too tender to touch and there is effusion with obvious crepitus. If so, immobilization for a week or so in a cock-up plaster must be maintained until the extreme tenderness has worn off, when massage can be begun. Manipulation is useless in the case of these long tendons.

In the lower limb, tendinitis is altogether less common. The less unusual places are the tendon of the rectus femoris just below the anterior superior spine, the tendo Achillis, the peroneal tendons on the outer side of the calcaneus (after a sprained ankle) and the tendon of the extensor hallucis longus at the big-toe joint. To date,

inflammation of the tendo Achillis has always yielded to one session of massage; the others take a week or two to obtain cure. Special reference must be made to inflammation of the tendon of the biceps muscle at the back of the knee, and of the semimembranous muscle at the groove on the tibial condyle. In obscure pains about the knee, one of these two structures is often at fault. Rider's sprain is said to be a tear of the tendon of the adductor longus from the pubes, but, in the cases I have seen, the lesion has been two or three inches below the bone; hence I class this condition with the muscles.

Periosteum

Injuries to the subcutaneous surface of the tibia often set up chronic pain, which yields to gentle decongestive massage.

Subcutaneous Fascia

Painful nodules sometimes form over the sacrum; I have not met them elsewhere. Strong friction does not remove them, but soon relieves the pain arising from them.

TYPES OF MASSAGE

There are six kinds of massage, each requiring a different technique:

(1) Pleasant treatments for convalescents, insomniacs, the rich, etc.

(2) For the maintenance of power and range in muscles and joints which are the seat, or near the seat, of an injury.

(3) To diminish oedema and traumatic periostitis.

(4) To combat the late effects of injury to muscle, ligament and tendon.

(5) To relieve rheumatic inflammation of muscle and ligament.

(6) To encourage the relaxation of unstriated muscle.

(1) Pleasant Treatments

These, consisting chiefly of effleurage, and kneading and picking up of muscle, are familiar to every [illegible]use. Medically, they are the least important of any masseuse's duties; [illegible] they reward the possessor of a good touch.

(2) For the Mai[illegible] Movement Immediately after an Injury

The hypothesi[illegible]ull proper treatment of recent post-traumati[illegible]mation is based as follow[illegible]tion of the body to an injury una[illegible]ion is always worse tha[illegible]; if there were no reaction the in[illegible]to- ward consequences; [illegible]n and swelling after an injury [illegible]ws that treatment must [illegible]cted towards abolishing as fa[illegible] re- action in the injured [illegible]and encouraging the patient to [illegible]lity remains. Massage diminishes the swelling and pain, a[illegible]rcu- lation, whereupon movements become possible (and ar[illegible] the masseuse) which would not otherwise have been made[illegible]ng, and the injection of anæsthetic solutions into the pai[illegible]tly different ways to promote active use of the injured[illegible]

(*a*) *In structures near the site of an injury.* [illegible] ture the patient keeps his arm in a sling and, if mid[illegible] and shoulder, although the injury is at the wris[illegible] getting him to put the shoulder and elbow join[illegible] ment every day. The simplest way to be certai[illegible] to supervise the movements; while massage w[illegible] encourage the patient.

(*b*) *In the structure actually injured.* T[illegible]

of the shoulder that has been reduced is damage to the capsule and muscles. The patient, left to himself, would keep the joint still on account of the pain, whereas the only way for him to recover full use of his arm is for movements to be begun at once. Massage is now of real help since it accelerates the circulation, reduces oedema, and encourages relaxation of the muscles, thereby diminishing pain and increasing the range of movement.

(3) For Oedema and Traumatic Periostitis

Any patient is the more comfortable for the passive removal of oedema, largely, I think, because the diminished tension in the subcutaneous tissues removes an impediment to free blood and lymph flow. In traumatic periostitis of the tibia—the only place where I have had occasion to treat it—gentle upward stroking on the same lines as for oedema appears to do good. Though the relief is at first rather temporary, after a few sessions it lasts longer and full relief is attainable in about a fortnight.

(4) For Combating the Late Effects of Injury to :

(*a*) *Striated muscle.* The sooner massage and movements are begun after an injury the better. Too often the scar in the muscle has been allowed to form adhesions owing to immobilization during healing, and massage by deep friction is essential to separate the muscle from fixed points (*e.g.*, bone) in its neighbourhood and to scars within itself. Provided that the massage is accurately placed and given firmly enough to reach the deeper layers of the scar, this can be softened and thinned, and the muscle passively stretched and actively exercised. Accurate placing of massage, however, is not always easy, since the area complained of by the patient may not contain the spot causing the pain. He may, for example, complain of a pain down the back of the thigh and the outer side of the calf ("sciatica"), which is due in fact to a gluteal fibromyositis; massage to the thigh and leg will be useless; to the buttock, curative. Or he may complain of a pain radiating horizontally across the lower back and which takes origin from the lumbo-sacral ligament, but his sensations are little guide to its position. Equally, a pain down the arm and forearm ("brachial neuritis") usually comes from the shoulder muscles, and a frontal headach[illegible]panies inflammation of the posterior cervical muscles near the occiput. In [illegible] case masseuses are much more often successful than bone-setters, becau[illegible] is of paramount importa[illegible] in muscular lesions.

([illegible]*d Capsule.* Chronic disability af[illegible]n is often relieved by [illegible] massage, and so is usually treat[illegible]ccessfully by bone-set[illegible]; nevertheless, massage follow[illegible]bilization gives the bes[illegible] period of time. Accurate pl[illegible]ot as difficult as in mu[illegible]inically; the pain is referred [illegible]hort way. But the lig[illegible]t, covers a very small area, so [illegible]great importance must be [illegible]the exact site of the scar. If an[illegible]usion is present in the join[illegible]' as far as treatment of the li[illegible] is concerned, but is [illegible]n also of the tear in the cap[illegible]can be identified, o[illegible]sule as the fingers can reach[illegible]*th.* Tendinitis due to over[illegible]ss not uncommon, and [illegible]e tendon has or has not a sheath. Firm friction [illegible]ckly gives relief, but the patient must be warned [illegible] some weeks, for fear of provoking a recurrence.

[illegible]ss.

[illegible]*ation of Muscle and Ligament*

[illegible]cute or chronic. When it is acute, the affected [illegible]gonizing. The muscle is swollen and tender;

heat relieves the pain for the duration of its application, but has little or no curative value. Massage on the other hand is quite painful and makes the muscle much more tender, but lastingly less painful to use.

The scars that follow attacks of rheumatism are similar, except in extent, to those resulting from injury, but they do not develop adhesions to bony points; hence, treatment by deep friction, given as hard as, and for as long as, the patient can stand it, is of paramount importance. The view exists that massage should skirt the really tender places, on the ground that they are "inflamed." On the contrary, it is because they are inflamed—but not infected—that they must be given massage. This advice is a relic of the days of Hilton, and shows the lack of understanding, even now, of the difference between the inflammation due, and that not due, to bacterial invasion. Active exercises are useful in strengthening the muscle; passive movements are pointless.

In short, the treatment of acute fibromyositis is massage, heat, and rest; of chronic fibromyositis, massage and exercises.

The only ligaments that are at all liable to rheumatic inflammation are the interspinous. An attack of acute rheumatism in them often recovers spontaneously; if not, it becomes chronic and then will last for years. Full relief is usually obtained in about four sessions of deep friction; neither passive nor active movements have any effect.

(6) For the Relaxation of Spasm of Unstriated Muscle

All muscle is liable to spasm, but particularly unstriated muscle, *e.g.*, that of the arterioles in Raynaud's disease and the bronchioles in asthma. Nowhere, however, is established spasm as intractable as in the alimentary canal, and every physician is familiar with the patient who has had years of abdominal pain due only to a length of spastic intestine. No drug yet discovered, and no operation yet devised, will give relief from spasm of the bowel; it is, therefore, particularly fortunate that manual vibrations applied to the intestine through the abdominal wall can cause relaxation, which, with repeated treatments, usually becomes permanent. I have not had the opportunity of trying the effect of vibratory treatment on spasm of the digital arteries, nor suprapubically in dysmenorrhœa in the hope that the vibration can penetrate as far as the uterus, but in theory either is quite a reasonable procedure.

CONCLUSION

These then are my views on what structures respond to massage, and how the technique of giving it may be varied. Deep friction is the really important movement for dealing with chronic muscular, ligamentous and tendinous conditions; manual vibration, for treating intestinal spasm. Mobilization sometimes is, and sometimes is not, an essential sequel to massage. Only when unanimity on the above points has been achieved will it be possible usefully to investigate the effects of friction, since not even empirical data can be accumulated from the results of quite different ways of giving the massage and carrying out the mobilization. Future research into the reason for the good results of massage must rest on a basis of agreement on what structures should be massaged, for what conditions massage should be employed, and what technique should be used. The suggestions made in this paper will, I hope, increase the accuracy with which massage is given, and thus hasten the day when uniformity in practice gives a clearer understanding of the manner in which massage achieves its effects.

PHYSIOTHERAPY IN DISEASES OF THE SKIN

(PART I)

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Physiotherapy in its various forms is now a well established part of the dermatologist's armamentarium. Many diseases can be treated by one or other of the physiotherapeutic methods while, in some conditions, physiotherapy is the only method of treatment. The various types of physiotherapy used in diseases of the skin are ultra-violet rays, X-rays, radium, diathermy, electrolysis, the high-frequency current and carbon-dioxide snow.

Dosage of Ultra-Violet Irradiation

If I begin with ultra-violet irradiation, it is not because this is the most important physical method, but only because it is less specialized, and is more easily available to the family doctor. It cannot be too strongly stated that ultra-violet irradiation is not a panacea for all skin diseases, though many non-dermatological writers would almost lead us to believe that it is. It is not even the method of choice in some of the conditions in which it is used. In most conditions it is as an adjuvant to other remedies that it is employed.

With regard to dosage, it may be taken for granted that, unless otherwise stated, a dose short of that required to produce erythema is administered, and the treatment is given daily except Saturday and Sunday. This general statement is preferable to attempting to give indications of dosage in terms of time and distance, a thing which, in my opinion, it is impossible to do satisfactorily, though some writers attempt it. Arcs differ in power, different carbons need different times of exposure to obtain the same skin effect, while mercury-vapour lamps differ greatly in output according to age and the type of lamp. These factors make it quite impossible to state definitely in terms of minutes what the exposure should be. Another point against such an attempt is the fact that there is, in my experience, a much greater variation in the skin reaction to ultra-violet rays than to some other forms of physical treatment.

Skin Tuberculosis (Lupus Vulgaris, Scrofulodermia, Tuberculides)

Tuberculosis of the skin is first and foremost a disease in which physical therapy plays an important part. Lupus vulgaris is not a common disease and, because of that, readers may think that it could be discussed at a later part of the paper. I discuss it first partly because it was the skin disease in which ultra-violet irradiation was first used. Another reason is that it is of considerable social and economic importance. Few people not intimately connected with lupus patients realize the handicap under which these patients live. As the disease affects the face most frequently they are ostracised and shunned by their fellows, and have difficulty in obtaining employment. They are, therefore, a burden to their relations or to the Public Authorities. Their lot has been altered by light treatment, especially during the last ten years. They must, of course, be placed as far as possible on the régime which all tuberculous patients should follow, namely fresh air, good food, satisfactory houses, etc., because it must not be forgotten that we are dealing with a general tuberculous infection with a local manifestation in the skin. General light baths should be given. It has been stated that these alone cannot cure lupus. With this statement I do not agree. Though the disease will not clear up in all cases, or even in most, yet in a fair proportion light baths alone will bring about a cure. This result will be hastened by the more recent, but more specialized, treatment with the Finsen-Lomholt lamp. It is more than forty years since Finsen showed that lupus could be cured with concentrated arc light, but the modification of the Finsen apparatus made by Lomholt has shortened the duration of each

application and the time required to bring about a complete cure. I am fortunate in having three of these Finsen-Lomholt lamps in my department at the Royal Infirmary, Edinburgh—the only hospital in the British Isles to possess three. One voluntary hospital in England has two, while recently the Glasgow Public Health Authorities have installed three in one of their tuberculosis Dispensaries. The results obtained with this lamp surpass those obtained with any other. I have used the Kromayer lamp in this disease, and have no hesitation in saying that the results are poor compared with those obtained with the Finsen-Lomholt lamp. Those particularly interested in the subject I would refer for fuller details to two other papers (1).

Scrofulodermia responds well as a rule. The discharge may become more profuse at first, but, as the treatment progresses, diminishes and eventually ceases. The associated glands, because this is the most usual cause of scrofulodermia, decrease in size and at length disappear, while the infection of the skin steadily improves till cure results.

The type of tuberculosis of the skin which is the most resistant to light treatment is the pseudo-elephantiasis type, and I have never seen much improvement brought about by irradiation in these cases.

X-rays should never be used in the treatment of lupus or scrofulodermia. The risk of carcinoma is great, while the cosmetic result is poor compared with that obtained with light treatment.

The tuberculides do well as a rule, especially lichen scrofulosorum which should clear up rapidly. Papulo-necrotic tuberculides take longer, months of treatment being required as a rule. Erythema induratum responds satisfactorily in the early stages, but when the parts have ulcerated, X-rays are better than ultra-violet rays. Four doses of 150r at intervals of a fortnight ordinarily cause the ulcers to heal up, when general ultra-violet irradiation may be given for the general condition.

Alopecia Areata

For alopecia areata many writers have claimed ultra-violet rays as an infallible cure. It is certainly a valuable remedy in many cases, but to speak of it as a specific remedy is to show a lack of knowledge and experience of the disease. The disease is very capricious, and the last remedy—and the last doctor—always get the credit for the cure. Dermatologists have been using the mercury-vapour lamp in the treatment of this condition for nearly thirty years, and I am certain that not one of them would deny that some cases fail to respond at all, even after prolonged treatment. There is no doubt that many cases do well under the treatment, but I have seen quite a number getting steadily worse even under vigorous ultra-violet irradiation. It is, nevertheless, a remedy to be tried, but the possibility of complete failure must be kept in mind. In alopecia areata the doses must be sufficiently great to produce a brisk reaction on the scalp. The redness ought to be allowed to pass off before another dose is given. In complete baldness it is useful to treat the head in sections at intervals of two or three days rather than the whole scalp at one sitting.

Furunculosis

Furunculosis benefits greatly from ultra-violet irradiation. General irradiation, with additional local irradiations, are indicated. This treatment is of most use in the chronic form where the boils appear either singly or in numbers over a long period. For single boils, X-rays are preferable. This subject has been recently discussed by Meyer (2). I have had no experience of short-wave therapy, as outlined by him.

Sycosis

In sycosis the results of ultra-violet irradiation are similar to the results of other forms of treatment, namely sometimes very gratifying, and sometimes very disappointing. It has been suggested that the superficial or bactericidal rays are the

1.—Aitken, R. (1936), *Edin. Med. J.*, *43*, 57, 194.
2.—Meyer, J. (1939), *B.J.P.M.*, *2*, 73.

important ones, but they are valueless. The organisms lie deep in the hair follicles, and the short bactericidal rays cannot reach them or account of their lack of penetrating power. It is inadvisable, as well as useless, to give an exfoliating dose in this disease. General light baths with the object of raising the patient's resistance to the staphylococcus are what should be given. On the whole, much better results are obtained with X-ray treatment. Some workers prefer to give at one sitting a dose of X-rays which will epilate the beard region. This is undesirable, as such a dose will later give rise to an X-ray scar with its atrophied skin and telangiectasis. It is preferable to divide the dose, giving 75 *r* at weekly intervals for five doses. The hair falls out later, but there is no risk of damage to the skin with this method. A patient who has had sycosis ought to remain clean shaven for at least a year afterwards, and not allow the beard or moustache to grow.

Psoriasis

Psoriasis is another disease in which brilliant results have been claimed by non-dermatological writers, but no dermatologist ever seems to have attained such results with ultra-violet irradiation alone. I have tested the effect of irradiation in several cases, smearing the one side of the body with ointment so as to prevent the rays acting on that side, and leaving the other side without that protection. There was no doubt that in some cases the side receiving irradiation twice a week, with ordinary treatment on other days, paled more rapidly than the side receiving ointment treatment only. Other cases, however, failed to respond, and some became worse under the treatment. The cases which respond best are those in which the patches are thin; when the patches are thick they are more resistant. This is what happens with other remedies also, the indurated patches being resistant to all treatments In stubborn cases, however, the method is well worth trying.

Sometimes the effect of light treatment is peculiar. On one occasion I was asked to undertake the treatment of a man with large indurated patches of psoriasis on which ordinary treatment seemed to make little or no impression. The irradiations had apparently just as little effect, and I advised him to discontinue the treatment. He resumed treatment with the ointment which, before beginning irradiations, he had been using without any benefit, and within a fortnight he was about 50 per cent. better. Evidently the light treatment had in some way altered his skin, and caused it to respond to an ointment which had had no effect previously.

Ordinarily I give doses short of those required to produce redness, as the disease may be spread by provoking a brisk reaction on the healthy skin. Even the exfoliating dose on isolated thickened patches is frequently without much effect, and the end results, as judged by relapses, are no better with irradiation than with any other form of treatment. At the same time light treatment is much cleaner than the use of greases, and patients, while fully realizing its limitations, sometimes prefer it to ointments on that account.

For the thick stubborn patches X-rays are of value, 150 *r* being given at intervals of a fortnight for three or four doses. A word of caution must be given here. Psoriasis has a great tendency to recur, and the temptation to use X-rays frequently is one which must be resisted. This is especially the case in children where the effect of X-rays on the bone marrow must be remembered. I have known of children who have been treated with X-rays by radiologists, and who have had a marked degree of anaemia as the result of the treatment.

Herpes Zoster

In herpes zoster little, if any, advantage is gained by irradiating in the attempt to clear up the vesicles. If the time taken as the result of using the technique outlined by various writers is worked out, it is seen that there is practically no difference between the time required for the vesicles to dry up under ordinary treatment and that required under light treatment.

Recently a paper was published in a French Journal in which the two authors gave their results of the treatment of shingles with ultra-violet rays. Thirty cases were given five doses at intervals of three days, the eruption having been present for five days. These cases were said to be cured, the implication being that the rays were responsible for this result. The duration of the disease was thus three weeks. The disease clears up without treatment in about that time, or in some cases less. It will thus be seen that the irradiation was of little or no avail. A larger number was given similar treatment, though the eruption had been present for from five to fourteen days. Most of these were stated to be cured without further treatment, but, as the same result would have been obtained with the use of a simple dusting powder as a protective, the radiation treatment was unnecessary. Such procedure can only lead to the remedy —and the medical profession—being discredited. I have known a patient develop herpes zoster while under light treatment for another condition, and the zoster ran a normal course. It is frequently said that irradiations will abort the disease, but this cannot be proved. Not infrequently the initial pain is severe and yet only a few vesicles appear. If such a case had been irradiated, the treatment would have been given the credit of aborting the disease, while the fact of the matter is that there would have been few vesicles in any case. It is for the pain which so frequently accompanies or follows the condition that irradiation can be employed with benefit. Even after only one or two doses the patient is able to sleep better, and in this way considerable benefit is conferred, especially in old people. When the pain persists after the eruption has disappeared, light treatment may also be given with benefit. The dose ought not to be an exfoliating one, but short of that required to produce redness. If too brisk a reaction is produced the benefit may be lessened, as the skin irritation prevents satisfactory sleep. For this persistent pain, the high-frequency current may be used, the vacuum electrode being applied over the area affected for five minutes twice a day.

Dermatitis

Dermatitis or eczema is such a wide subject, and comprises so many different forms, that it is impossible to do justice to it in the course of a short article. It must be remembered that dermatitis is not an entity, but rather a group of symptoms. As our knowledge advances, more and more conditions are being removed from what Sir Norman Walker calls "the rubbish heap of eczema." An effort must be made to elicit the cause, but not infrequently all investigations give negative results. Acute cases of dermatitis are not suitable for light treatment, the best results being obtained in the chronic cases. In some cases, especially in hospital work, the radiations are useful, more for improving the patient's general condition than for any special effect they have on the eruption. While far from recommending that light treatment be given to every case of dermatitis, I do think that, where the condition has resisted proper treatment, it is worth while trying the effect of ultra-violet irradiation.

X-rays are of more value than ultra-violet rays in some types of dermatitis. Where there are only a few patches, especially if the skin is thickened and leathery, X-rays will help greatly. In the form known as neurodermatitis, X-ray treatment is the best form of therapy. Doses of 150 *r* at intervals of a fortnight for three or four doses will transform the leathery skin into supple and pliable tissue, and the itching will be completely relieved.

There are some forms of itchy dermatitis in which the chief element is the papule, or small patches, which do not clear up under ordinary treatment. They are too widespread for X-ray treatment. These cases respond to high frequency. They are troublesome and require a good deal of patience because of the amount of surface to be treated. It is better to treat the patient daily, the application being made to different areas so that the same areas are treated on alternate days. The vacuum electrode is passed over the affected part for five minutes, the current being mild, but the treatment must be persisted in for several weeks before the condition is likely to clear up.

SOME EXAMPLES OF DIATHERMY AND SHORT-WAVE APPARATUS

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Continuing the Series of Papers on
ELECTRO-MEDICAL APPARATUS : ITS CHARACTER, OPERATION AND CARE : PART II. No. 10 (continued)

The "Novotherm 300"

The "Novotherm 300" is a valve maintained short-wave apparatus devised to give reliable working with reproducibility of dosage, simplicity of control and low running costs. The manufacturers, Messrs. Watson and Sons (Electro-medical), Ltd., have incorporated a British-made valve (G.E.C.) which has a guaranteed filament burning life of 1,000 hours. A time counter is provided in the circuit to indicate the number of hours for which the valve has been used. The wave-length of the machine is 6 metres, and the output 300 watts continuously. It can be operated from A.C. mains of voltage from 145-250 volts, an auto-transformer being supplied to facilitate this.

General Arrangement. The general arrangement of the components can be seen from figures 156 and 157. In the bottom of the cabinet is the main transformer (1), and the time counter (2). Above are the valve (8) with its radiator (9) arranged in the ventilating cone (10). The oscillating coil (7) comprises two turns of copper tubing, and is connected between the anode and the grid, this coil being energised from the secondary of the high voltage transformer through a choke L as shown in the wiring diagram (Fig. 158).

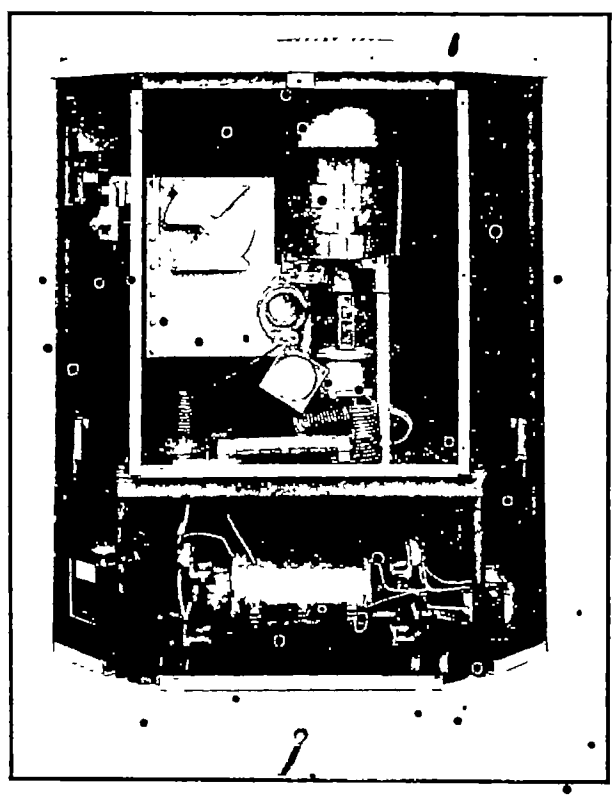
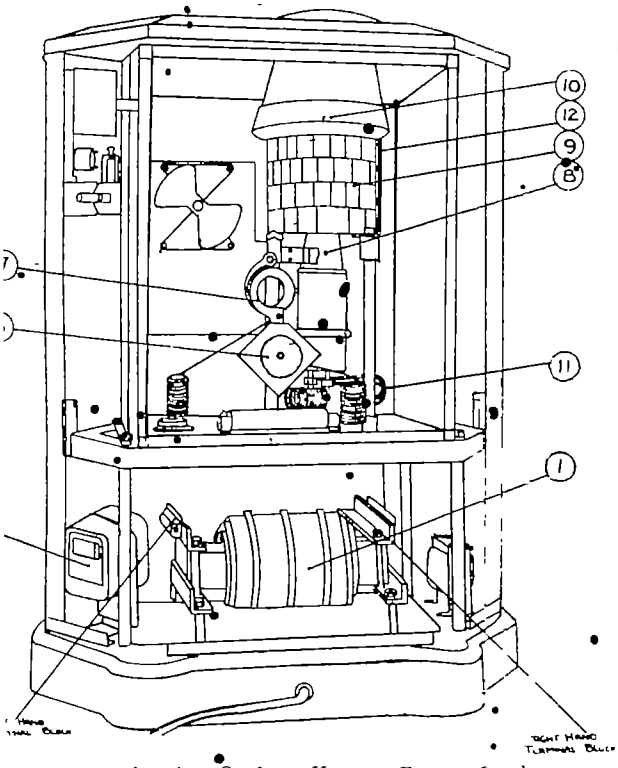


Fig. 156 —*Photograph of Watson "Novotherm 300" with back of case removed to show components.*

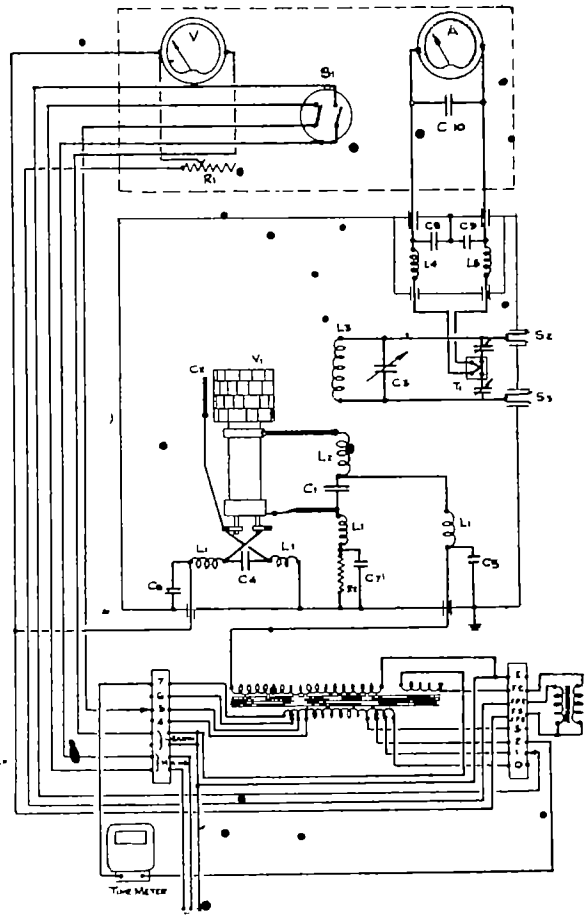
A novel form of condenser C_2 is introduced between the valve anode V_1 and valve filament. It consists of a metal "flag" supported near the anode radiator by a metal strip connected at the bottom to one side of the filament. This condenser is provided because it has been found that additional capacitance across the valve is necessary at wave-lengths of the order of 6 metres.

The output, or patient circuit, consists of an inductance L_3 with a variable condenser C_3 across it. This is the patient tuning condenser. The leads to the patient are plugged in at S_1 and S_2.

Current-Measuring Circuit: The current-measuring circuit is rather



ig. 157 (above)—Outline Key to Fig. 156, showing components of the "Novotherm 300"



ig. 158 (right).—Wiring diagram of Watson "Novotherm 300."

unusual, and consists of a thermocouple T_1 which is connected to the two output terminals S_2 and S_3 through two small variable condensers. (These condensers are only variable to permit adjustment of the ammeter reading during tests). With this arrangement the thermocouple receives a maximum current when the patient circuit is tuned, so that a maximum voltage exists between S_2 and S_3. The leads connecting S_2 and S_3 through the patient circuit are made exactly a quarter of a wave-length long, and with maximum voltage at S_2 and S_3 there is, of course, maximum current at the patient electrodes which are a quarter of a wave-length away. It is thus possible to measure the actual current flowing across the two patient electrodes, a procedure which is not possible with the ordinary series ammeter. With this arrangement, moreover, the power delivered to the patient for any given electrode-setting is proportional to the square of the ammeter current. Although this arrangement is in no sense a dosage measuring system, it can be safely called a *dosage reproducing system*, for, if the electrode set-up is reproduced at any time and a given ammeter reading indicated, then the dose will be, within reasonable limits, the same as on a previous treatment.

The thermocouple T_1 is connected to the current-measuring instrument A through chokes L_4 and L_5. Ammeter shunting condensers C_6, C_8 and C_{10} are also provided.

Controls. The apparatus is very simple to control by means of a main switch S_1, a rheostat R_1 and a variable condenser C_3. The switch and two control knobs are mounted with the valve-filament voltmeter and patient current meter on a panel arranged in front of the cabinet. The rheostat varies the voltage across (and current

through) the valve filament, and therefore the current in the oscillating coil L_2. This in turn governs the energy received by the patient circuit. The controlling condenser is in the patient circuit, and effects the tuning.

It is claimed that the actual cost of operating the "Novotherm 300" including valve replacement costs, but excluding any allowance for depreciation, is from 5d. to 7d. per hour according to the charge for power supply.

The apparatus can be used for cable or condenser-field technique, and many types of electrode are available.

The Theracoupler

This instrument, a product of Messrs. Marconi-Ekco Instruments, is designed chiefly for cable technique, but an attachment for work with condenser fields is available. The machine illustrated in fig. 159 weighs only 65 lb. and measures 24in. x 12in. x 12in. The apparatus incorporates a valve oscillator which is guaranteed for 1,000 hours, and a counting device to ensure that the operator obtains this service.

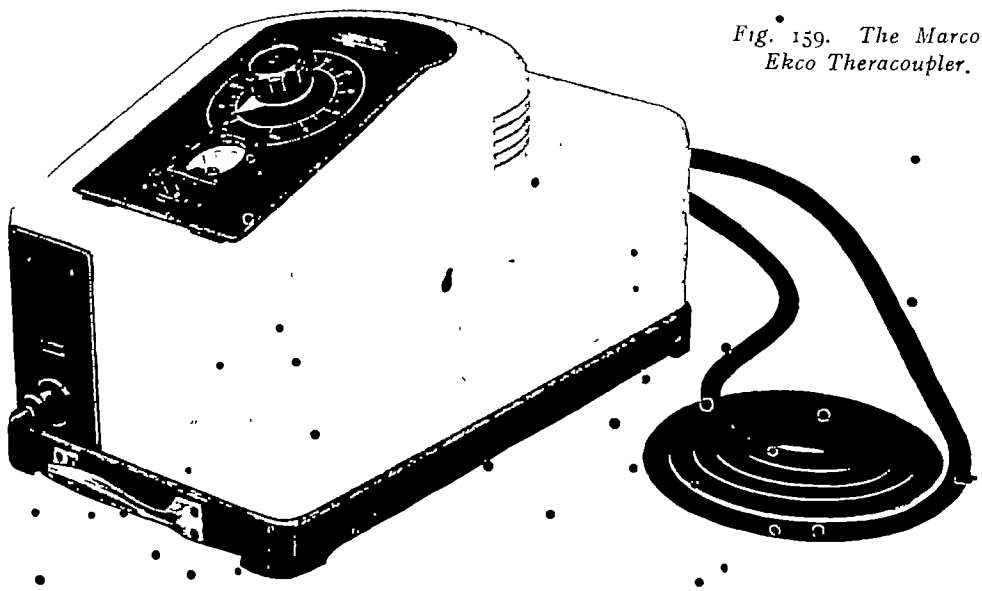


Fig. 159. The Marconi-Ekco Theracoupler.

Circuit and Controls. The circuit, as shown schematically in Fig. 160, is of the self-rectifying type, operating from a normal A.C. power supply through a transformer. The patient coil is coupled to the oscillator by means of condensers (*i.e.*, capacity coupling, see February number of the *B.J.P.M.*), and the output is controlled by varying the grid voltage with the help of a variable 2,000 ohm rheostat in series with the grid of the valve. This is the only controlling device so that the operating panel comprises simply a graduated handle for intensity variation, an instrument for indicating the power (watts) dissipated in the patient circuit, and an on-off switch.

The apparatus is designed to be connected to an alternating current circuit, tappings being provided on the mains transformer for voltages between 200 and 250. The current consumption is about 4 amps for a maximum output to the patient of 160 watts.

The Theracoupler in Use. An example of the use of the Theracoupler is illustrated in fig. 161, which shows the cable disposed for the treatment of sciatica. The patient lies prone, and four or five layers of towelling are laid over the affected area. The cable is formed into a $2\frac{1}{2}$ turns coil with the free ends down the legs at a distance of about 5 inches apart.

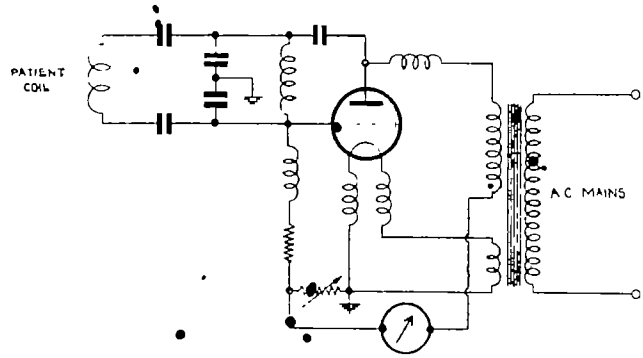


Fig. 160.—Schematic diagram of the circuit of the Marconi-Ekco "Theracoupler."

The cable can be coiled round limbs, or laid in loops and pancake coils, over affected parts of the body. The coil field technique, as will be recalled from last month's article, makes use of electromagnetically produced eddy currents for heating; this heating is in direct proportion to the electrical conductivity of the region concerned, so that muscular tissues, which are of a higher conductivity, receive more heating by this method than fatty tissues.

The Intertherm Short-Wave Apparatus

This equipment, a product of Messrs. Stanley Cox, Ltd., is another example of an A.C. mains-fed valve unit. The circuit diagram, Fig 162, shows that the mains transformer comprises a primary and two secondary windings, one of which energizes the valve and is connected to plate and filament, while the other is used to heat the valve filament. The valve-energizing secondary winding is connected at one end to the plate through a high frequency choke and anode (oscillator) coil, while the other end of this winding is connected through a 6,000 ohm variable rheostat and milliameter to the filament. The filament circuit is connected to earth, and therefore the rheostat and milliameter are practically at earth potential. Condensers are connected across the milliameter, variable rheostat and transformer secondary in order to by-pass any high-frequency currents from the oscillating circuit reaching these parts and tending to injure them.

The Oscillating Circuit. This consists of the valve, the plate (oscillator) coil, the grid coil, and a condenser. The condenser permits the high frequency current to oscillate in the plate-to-grid circuit, but prevents the high voltage from the mains transformer secondary reaching the grid. (The condenser offers little reactance to high-frequency currents in the oscillating circuit, but offers a very high reactance to the 50-cycle currents from the transformer). The values of inductance and capacitance in the oscillating circuit have been chosen so that the oscillation frequency is just below 50,000,000 cycles (6 metres), so as to avoid interference with the Post Office



Fig. 161.—Arrangement of "Theracoupler" cable for treatment of sciatica.

television broadcasts.

The Patient Circuit. The resonator coil is wound round the oscillator coil, so that the two are fairly closely coupled. The ends of the resonator coil go to the output terminals to which the condenser electrodes or cable are connected. A variable condenser, however, is connected in parallel with the resonator coil to permit tuning. Although the milliameter in the plate circuit of the valve gives a rough idea of tuning (since at resonance the input to the valve increases), a special tuning indicator is provided in the Stanley Cox machine which indicates the resonance point accurately. This is done by a small local circuit with instrument coupled to the patient circuit.

A neon pilot light is included in the main supply circuit to show when the machine is turned on. A neon light is chosen in preference to an ordinary bulb since it is less liable to burn out under the influence of stray high-frequency fields.

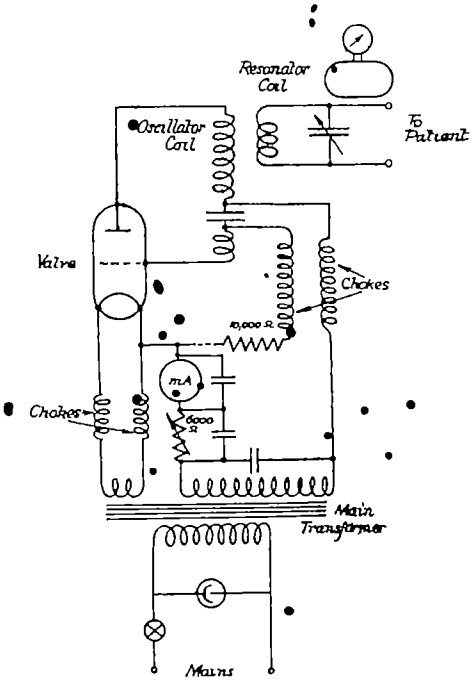


Fig. 162 —Connection diagram of Stanley Cox Intertherm Short-Wave Apparatus.

Care of Short-Wave Apparatus

In general it is advisable that only personnel skilled in short-wave electrical work should attempt adjustments to the inside of a short-wave machine, and therefore the manufacturers should be called in to attend to breakdowns. Fortunately there are few things in most short-wave machines which are liable to give trouble. Valves, as we have seen, usually have a guaranteed life of 1,000 hours, but they need replacing from time to time. Operators should, however, keep an eye on the condition of the accessories which make up the patient circuit. Such things as connection plugs and screws for condenser electrodes and cables should be maintained in good order. The rubber on electrodes and cables may deteriorate with age, and these components should be renewed whenever there is evidence of cracking or flaking of the rubber, or when it loses its flexibility or becomes brittle. Faults of this kind are liable to give rise to extraneous high-frequency discharges, and consequently shocks and burns may result.

Interference

Some short-wave machines in certain circumstances produce interference with radio and television apparatus. This interference is of two forms, that directly radiated and that conveyed on the mains; the latter is generally more serious. The mains-borne interference arises from high-frequency currents being induced from the oscillatory circuit into the mains transformer windings, and being transmitted thence along the lighting and power mains to which the machine is connected. If not properly eliminated by chokes present in the machine, the transmission of the high-frequency disturbances may be prevented by connection of a combination of choke coils and condensers between the mains and the machine, so that the high-frequency disturbances are not conveyed along the mains. Special filters are designed as interference suppressors, and may be fitted between the mains terminals and the input terminals to the machine.

Direct radiation is dealt with by the rather more cumbersome expedient of enclosing the operating room in a metallic cage. This, however, can be done fairly simply by building a wooden or metal framework enclosing the space in which the

machine is to be used. Small gauge "chicken wire" can be used to make the cage, and all parts (including the entry door) must be bonded together and earthed.

The elimination of interference is a particular subject for which the advice of specialists should be obtained. The matter is mentioned here as representing one of the problems associated with the production and use of short waves.

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

Massive U-V-R as an Adjuvant Treatment in Erysipelas

H. W. Willis (*Arch. Pediat.*, 1939, lvi, 39) divided his cases into two groups; the first group of 30 cases was treated routinely with moist compresses, antitoxin, blood transfusions, and U-V-R in small doses; the second group of 30 cases was treated with massive U-V-R as an adjuvant to the treatment used in the first group. The results were as shown below.

The excellent results obtained are not attributed solely to massive doses of U-V-R, but to the proper application of the different methods of treatment.

Infants under six months.

	Group 1: Routine treatment + 1 erythema dose of U-V-R.	Group 2: Routine treatment + 6 erythema doses of U-V-R.
Number of cases	7	8
Average age	3 months	2·8 months
Average days of fever	6	3
Average hospital days	13	8
Mortality	3 (42.8 per cent.)	None

Infants over six months, children and adults.

	Group 1: Routine treatment + 1 erythema dose of U-V-R.	Group 2: Routine treatment + 6 erythema doses of U-V-R.
Number of cases	23	24
Average age	41·2 years	41.5 years
Average days of fever	5	3
Average hospital days	12	8
Mortality	2 (8.6 per cent.)	None

Artificial Fever Therapy in a Private Hospital

G. A. Ledbetter (*Texas State J. Med.*, 1939, xxxiv, 153) reports on the physiotherapy department in the memorial hospital in Houston, Texas. Since 1935, when this department was started, 484 artificial fever treatments have been given to 115 patients. All the treatments were given by a low radio-wave inductotherm, combined with a circulating hot air cabinet. The following conditions were considered as contraindications to the treatment: nephritis, advanced arterio-sclerotic heart disease, marked valvular lesions with myocardial weakness, severe hypertension, hepatic cirrhosis, severe anæmia and severe malnutrition. The results in 90 cases were as follows —

Disease	No Patients.	M	F	Average age	Average No. treatments	Average duration of treatments. Hours	Cured %	Improved %	Not Improved %
Gonorrhœa ..	25	14	11	28	3	4	56	28	16
Gonorrhœal arthritis	15	11	4	30	4	3	54	33	13
Chronic infectious arthritis	34	11	23	36	4	3	56	29	15
Sciatica . .	7	3	4	35	4	3	57	43	0
Syphilis .	9	7	2	44	9	4	44	23	33

Ultra-Violet Light and Cancer

F. Ellinger (*Fundamenta Radiol*, 1939, 4, 181) employed ultra-violet rays from a mercury-vapour lamp, at a distance of 40 cm., using white mice for his experiments. Ultra-violet irradiations, in doses 1 to 2 times the erythemal dose, were found to have a stimulating action on the growth of inoculation tumours (Ehrlich's mouse carcinoma). This effect in increasing the growth of the tumours was closely connected with the erythemal efficiency. The necessity for avoiding sunburn by too much sunbathing is pointed out as a possible danger in the production of cancer.

Short-Wave Diathermy in Lung Abscess

H. G. Brugsch and J. H. Pratt (*J.A.M.A.*, 1939, 103, 2, 114) report on 3 cases of acute, and 6 of chronic, abscess of the lung, treated by short-wave therapy. Treatments were usually given daily, beginning with an initial one of 10 minutes' duration, gradually increased to 30 or 45 minutes. Glass electrodes, 20 cm. in diameter, were employed, placed usually from 4 to 6 cm. from the skin; the wave lengths were from 4 to 6 cm. A two-vacuum tube machine, with an output of 500 watts generating a 6 meter wave-length, was used. In one acute case the symptoms rapidly disappeared, but a small cavity persisted, in spite of 113 treatments: the patient remained clinically well for over a year, and then the symptoms returned and the abscess enlarged, so that surgical treatment was required. In the other acute case, the abscess increased in size, and surgical treatment was necessary. Of the 6 chronic cases, no improvement resulted in 2; in a third, lobectomy had ultimately to be performed, and death occurred; and in the 3 other cases the symptoms were uninfluenced and surgical treatment was necessary. The authors have collected 129 cases from the literature, of which 87 (67 per cent.) recovered.

Results of Ultra-Violet Irradiation during Laparotomies

T. Marti (*Bruns Beitr. z. klin. Chir*, 1939, 149, 84) made use of a modified Havlicek technique of filtered ultra-violet light during laparotomies for various abdominal operations, and found that there was a decrease in the abdominal pain in most cases; in some, however, a sedative was also required. Ultra-violet light was found to stimulate peristalsis and to be of great value, especially in strangulated hernia. In cases of diffuse purulent peritonitis the reaction was particularly marked in assisting a cure. The incidence of post-operative thrombosis, emboli and pulmonary complications was lessened.

Pityriasis Rosea

G. H. Curtis (*Cleveland Clinic Quarterly*, 1939, 6, 29: *Abstr. Arch. Phys. Therapy*, 1939, 20, 314) recommends in cases of pityriasis rosea with marked pruritus the use of a lotion consisting of phenol, 1 to 2 per cent., resorcin, 2 to 3 per cent., zinc carbonate, 10 gm., zinc oxide, 10 gm., olive oil, 64 c.c., and lime water to 128 c.c. If it is desirable to shorten the course of treatment, ultra-violet irradiation should be used. The results are generally good. The skin is irradiated at the first treatment for one minute at a distance of 30 inches, and afterwards the daily dosage is increased by one minute to 15 minutes, the distance being shortened by one inch daily, until the dosage is 15 minutes at 18 inches distance. The eruption usually begins to disappear in about two weeks.

Management of a Hay Fever Ionization Clinic

P. Franklin (*Brit. Med. Jour.*, 1939, 1, 871) describes the management of the Margaret Street Hay-Fever Ionization Clinic and the results obtained in 1938, as compared with those in 1937. On arrival, the patient has his nose sprayed with a 2 per cent. solution of larocain. The nose is then packed with thin squares of cotton-wool and a single layer of gauze soaked

in a 1 per cent solution of zinc sulphate. The patient is then passed into the ionization room, and the nurse applies the electrical treatment for 15 minutes from an electric battery consisting of 30 Leclanché cells, each patient being provided with an ionization set consisting of a wooden box with a sliding resistance, a milliamperemeter and terminals connected with the battery. The percentage results obtained for the years 1937 and 1938 were as follows :—

	1937.	1938.
Patients free from hay fever during the season ..	9	18
Greatly improved	35	50
Slightly benefited ..	46	25
Not benefited	8	6
Made worse	2	1

Nasal ionization was therefore beneficial in 93 per cent of cases.

Physiotherapy in Neuritis

J. Cowan (*Clin. Jour*, 1939, 68, 203) discusses the symptoms of neuritis and its treatment by physiotherapy. For pain, the best agent is heat, either by means of infra-red rays or ultra-violet light, if deep heating is not indicated; in the latter case, long- or short-wave diathermy is advocated. Other means to achieve the same purpose are anodal stabile galvanism, ionization with chlorine, iodine, or histamine ions, and effleurage. Petrissage or tapotement should not be employed. For tenderness, external infra-red irradiation, anodal stabile galvanism, light effleurage, and especially a fine high-frequency effleuve are valuable. As to loss of function, atrophy of muscles can be prevented to some extent by the use of surged galvanic currents or by slow sinusoidal currents. Severe stiffness of joints can be avoided by massage and passive movements. Stimulation of the sensory nerve-endings by means of the faradic current by a wire brush electrode should be used for loss of sensation. A high-voltage coil is the best. If superficial heating is desired, 10 to 15 minutes' treatment suffices, but 30 to 40 minutes may be required for deep heating.

Combined Heating Technique in Gonorrhoea in Women

W. Bierman and E. A. Horowitz (*Med. Rec.*, 1939, 154, 305) raise the systemic temperature by short-wave currents, while the patient lies in a cabinet heated by electric lamps. After the systemic temperature has reached about 106 F., local heating is applied to the pelvis by special vaginal electrodes, one being connected with a terminal of the diathermy machine and the other to three belt-electrodes made of Crooks metal. One belt is placed around the waist and one around each thigh just above the knee. The most satisfactory form of sedation was found to be morphine sulphate, ¼ gr., and hyoscine hydrobromide, 1/400 gr. Of 185 cases treated by the authors, 93 per cent. became free from the gonococcus.

Marconitherapy in Slowly Resolving Broncho-pleuro-pulmonary Inflammation

C. Guidotti and I. Pinelli (*La Radiol. med.*, 1939, 26, 409) make use of an electrotherm of 300 watts with a 6-metre wave-length; the electrodes are placed symmetrically opposite each other on the back and on the chest, their size depending upon the extent of the lesion. The daily sittings are progressively lengthened from 15 to 30 minutes, the number varying according to the progress of the disease, as revealed by radiography. Eight cases are described of children aged from 9 months to 6 years. Short waves are considered to have a specific biological action on the tissues, to possess a germicidal action, but especially to produce vascular alterations. In 2 of the cases the results were not entirely favourable, owing to the presence of small, diffuse foci, which were resistant to the treatment.

Indications and Technique of Iontophoresis

F. Baker (*Arch. Phys. Therap.*, 1939, 20, 197) treated 8 cases of varicose ulcers by the following method: Asbestos paper saturated with an 0.5 per cent. solution of acetyl-beta-methylcholine chloride was wrapped about the leg from the knee to the foot, avoiding open ulcers. Malleable metal plaques were placed over the asbestos paper and connected with the positive electrode of a galvanic battery. A large moist pad-electrode was placed on the back. A current of from 20-30 ma. was gradually turned on, and continued for 30 minutes. Three treatments were given a week. The results were poor. Much better results were produced by pressure, using sponge rubber and adhesive strapping. Five patients suffering from advanced peripheral vascular disease were treated by histamine iontophoresis, employing a 1 in 10,000 solution. The results were not striking. Forty-one patients suffering from arthritis were treated by histamine acid phosphate (1 in 10,000) iontophoresis. The results were as follows.—

	Treated.	No. of treatments.	Results.
Hypertrophic arthritis	12	3 to 20	Not so satisfactory.
Heberden's nodes. Acroparaesthesia	10	7 to 30	6 showed improvement with temporary relief of pain.
Rheumatoid arthritis, hands and feet	12	5 to 30	7 improved.
Traumatic arthritis	7	6 to 75	6 markedly improved, 1 failed to co-operate.

Physiological Considerations of Artificial Fever Therapy

M. G. Schmitt (*Arch. Phys. Therap.*, 1939, 20, 227) draws attention to the necessity for considering the condition of the heart, the concentration of non-protein nitrogen and sugar in the blood, adequate hydration before fever therapy, elimination, and sedation. The heart can be spared by the use of the electrocardiograph in selecting patients, by the use of internal electrical induction, by adequate hydration before and during treatment, and by adequate sedation. The blood-sugar level should be known. Peripheral vascular failure can be avoided by employing internal electrical induction of heat, by abstaining from the use of drugs of the belladonna group, by avoiding conditions approaching shock, and by the production of adequate hydration. The latter can best be done by giving the patient on the day preceding treatment two quarts of fluid in addition to the usual amount of fluid taken; one quart of this should consist of sodium chloride 1 per cent., glucose 3 per cent., and gelatine 3 per cent. This should be served hot, and taken at the rate of 3 to 4 oz. per hour. Elimination is best produced by cleansing the large bowel the night befort treatment, and sedation by giving one or two hypodermic injections during an 8-hour fever curve, consisting of papaverine hydrochloride, gr. 1/3, pantopon, gr. 1/3, atrinal, gr. 1/6.

REVIEWS of BOOKS on Physical Medicine and Allied Subjects

Life of an Idealist

Sir James Cantlie: A Romance in Medicine. By Neil Cantlie and George Seaver. Price 10s. 6d. London: John Murray, 1939.

Sir Arthur Keith, who knew both Sir James and Lady Cantlie well, has written an introduction of 18 pages. He warns his readers not to expect his opinion to be unbiased, but he marshals his facts lucidly and provides ample reason for his admiration.

Cantlie's life can be divided into four periods, as follow:—

1851-1872.—Formative early years in Scotland, which Keith considers important factors in Cantlie's development, and which he compares with his own similar upbringing and environment.

1872-1877.—Life as a medical student and graduate in London, and the beginning of his plan for a Volunteer Medical Corps.

1887-1896.—Fighting plague and cholera in Hong Kong and Egypt, association with Dr. Manson and acquaintance with Sun-Yat-Sen.

1896-1922.—Return to London and the inauguration and furtherance of his projects.

Sir Arthur Keith describes Cantlie as "dreamer and doer combined," and says "from his arrival in London in 1872 until his death in 1926, never a year passed without his having conceived some new idea and put it into practice."

In these days it is difficult to realise what an innovation the Volunteer Medical Staff Corps was, and how much initiative and toil had to go to its making.

Fired with courage and enthusiasm, Cantlie's energy seemed untiring, and he never failed to respond to any call for special service to mankind.

Cantlie's set of values stood the test of use, he sacrificed personal aggrandisement and wealth to disinterested labour for great ideals. It was said that when he died his only fortune was his four sons.

Though the book is a biography of Sir James, it contains much about the life of his wife and staunch friend, Lady Cantlie. Indeed, so closely interwoven were their lives, that no biography of the one could exclude that of the other.

Differing in many characteristics, each seemed to supply what the other lacked, and they always had in common their love of humanity.

The authors have carried out their task with precision and restraint, and the book deserves readers who remember the Cantlies' times and those who came later.

It might be well to read this truthful "romance of medicine" in the same week as we examine the "mirror" of current fiction with its often distorted reflection of the medical profession. M. E. O.

Diathermy and Short-Waves

Diathermy: Short-Wave Therapy, Inductothermy, Epithermy. By William Beaumont, etc. London.

This book is intended as a practical guide for students of the Chartered Society and for medical practitioners. The author has fulfilled this task in an excellent manner. In the first chapter he gives a very clear and concise account of the physical characters of high-frequency currents. He has admirably succeeded in defining in a few words such difficult items as damping, resonance and coupling, in a way every student can understand; the distribution of high-frequency in tissues is also well described.

Chapter 2 describes and illustrates the different diathermy generators. Chapter 3 explains the essentials of the physiological effects of diathermy. Chapter 4 deals with the technique of the different applications, types of electrodes and dosage, and contains useful illustrations. In Chapter 5 the risks and dangers and the contraindications are described. Chapter 6 gives the special technique for application to joints, muscles, the back, the cervical, dorsal and lumbar region, and also in some special diseases. This is supported by a very clever method of illustrating the most suitable places for applying the electrodes. Chapter 7 deals with the treatment of heart, lung and genito-urinary conditions, diseases of the special senses, and some general diseases. Epithermy or high-frequency currents (also called D'Arsonvalisation) are the subject of Chapter 8. The apparatus, forms of application and indications are described in brief, although the author apologises for including this form of electrotherapy in a textbook of diathermy.

The author on different occasions stresses the identity in principle of classical diathermy and the new development, short-wave diathermy, with regard to the distribution of the energy and the physiological effects, pointing out, however, some advantages in using the condenser field, or deplacement currents, over the direct contact applications, as in classical diathermy. After reviewing, in Chapter 11, the different short-wave generators available, he explains the technique of application and the peculiarities of the use of the electrodes, and illustrates different applications to the limbs and to the body. The various diseases in which short-wave diathermy is recognised as an efficient method of treatment are reviewed. The last chapter, No. 10, deals particularly with inductothermy. Clinical experience in the technique of application is fully explained for all practical purposes. There is an Appendix containing a glossary of technical terms, which is remarkable for the concise and clear definitions it gives.

The book is written in an easily understandable fashion. Any student or medical practitioner without special knowledge of physics will read it with great advantage. It is free from theoretical discussions, and gives all the practical details which should enable anyone who wishes to take up this field of medical treatment to apply diathermy in a correct manner in his practice. Although the book is easy to read and to understand, one feels that the author has a sound background of physical and medical knowledge. Only a master teacher could write such a text-book. K. T. N.

INTERNATIONAL SOCIETY OF MEDICAL HYDROLOGY

The next Annual Meeting of the Society, which is open to non-members on payment of a fee of £1, is to be held in Florence and the neighbouring spas, in Italy, from the 14th to the 19th October, 1939. Members of the Congress will be housed in Montecatini for the first four days, and in Salsomaggiore for the fifth, but the ceremonial opening meeting and first discussion will be held at Florence. A visit will be paid to Viareggio and neighbouring seaside resorts. After the meeting there will be optional excursions to—

(a) Genoa—Acqui—Turin; (b) Abano—Padua—Venice; and (c) Siena—Chianciano—Rome.

The inclusive charge per head will be 450 Italian lire. Subjects for discussion will be:

(a) "Physico-chemical studies of the Perspiration occurring after Treatment by Peloids."
(b) "Spa Treatment of Diabetes."
(c) "The Action of Solar Rays on the Skin of Children."

Papers may be read in English, French, German or Italian, and translations will be provided.

A conducted party will be arranged to travel from London. Full information is obtainable from the I.S.M.H., 22, Bedford Place, London, W.C.1.

THE SOCIETY of PHYSIOTHERAPISTS

The Massage Corps.

In the *Supplement* circulated to members of the Society with the June issue of the *British Journal of Physical Medicine*, details were given of the Massage Corps, which is being organized by the Chartered Society of Massage and Medical Gymnastics, at the request of the Ministry of Health, for service in the event of war.

The Society of Physiotherapists has been approached by the Chartered Society to co-operate in this matter. The Executive Committee has replied that they will be pleased to assist, and has raised certain points with regard to the status and terms under which members will be expected to serve. No further information has been received, but as soon as it is to hand it will be circulated to members.

Following the announcement made last month, several letters have been received from members, who have requested enrolment forms; but the response so far is by no means large enough. The Executive Committee would again urge upon those who have not already come to a decision in this matter the importance of doing so without delay. The Society of Physiotherapists will be pleased to send enrolment forms to any registered medical auxiliary physiotherapist. (Applications should be addressed to the Hon. Secretary, Society of Physiotherapists, 150, Victoria Street, London, S.W.1).

The Society of Physiotherapists would again impress upon its members, and medical auxiliary physiotherapists generally, the importance of making this Massage Corps as large as possible. Unless the registered physiotherapists come forward in sufficiently large numbers to supply the national need in the event of war, it follows that the unregistered will be enrolled, and the good advances made during the past six years with regard to the status and registration of medical auxiliary physiotherapists will to a considerable extent be lost.

Post-Graduate Lectures.

On Wednesday, July 5th, Dr. L. G. H. Sarsfield gave a second lecture to members of the Society, concluding his subject, "The Theory of Short Waves." Again Dr. Sarsfield dealt with this subject in a most interesting manner, and the warm applause he received at the conclusion indicated how very much his audience had appreciated his lecture.

The Executive Committee is arranging for further lectures to be held in the autumn of this year, and full details of these will be announced at an early date.

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New Royal Baths Extension, Harrogate

The new £100,000 Spa Extension Scheme of Harrogate was opened by the Lord Mayor of London on Monday, July 10th.

This new scheme provides for an entirely new building, in which exclusively Harrogate mineral water treatments will be administered. The equipment of the building, the treatment apparatus, etc., is of the latest design, and may be considered as the last word in spa technique. In the new building it will be possible to carry out a thousand treatments a day. A new lounge hall has also been constructed for the recreation of patients undergoing treatment, this is luxuriously furnished and conforms to the general plan of the whole extension scheme. Between the new building and the lounge hall is a fountain court surrounded by a covered colonnade; this is heated and enclosed in glass shutters in winter. Here, patients may obtain gentle walking exercise while drinking of the spa waters, and also between treatment.

The conception and execution of Harrogate's Development Scheme marks a great advance for this famous Spa, and must surely definitely consolidate its position as one of the leading Spas of Europe.

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THE BRITISH JOURNAL OF PHYSICAL MEDICINE

AUGUST 1939 *And International Review* Vol. 2. No. 8. New Series

Original articles are invited on any aspect of Physical Treatment. Such articles are published only on the understanding that they are contributed exclusively to this Journal, *which does not hold itself responsible for statements made or opinions expressed by any contributor. The copyright of all articles appearing in the* Journal *is strictly reserved.*

Short-Wave Therapy

WHEN short-wave therapy was introduced into this country a few years ago it was considered by some to be just another new method for which somewhat extravagant claims were being made, and which would prove of only passing interest.

It may be of interest now to review some of the outstanding successes achieved by this type of therapy, and to what extent therapeutics has been enriched by its addition.

The controversy as to whether ultra-short wave therapy has any specific biological effects, or merely depends on its capacity for inducing heat in deep-seated tissues, is too well-known to require elaboration. On a subject concerning which leading physicists and physiotherapists disagree it would be futile to offer our opinion. On the much more important question, from the practical viewpoint, as to the therapeutic results obtained from short-wave therapy, controversy must be silenced by the impressive number of conditions in which it offers a measure of alleviation and cure superior to other therapeutic methods.

The first treatment of a human disease with short-wave therapy was carried out by Schliephake on himself in 1929 for a very painful nasal furuncle. In two days' time this was completely cured. Since then short-wave therapy has been accepted as a most rapid, safe, and effective means of alleviating and curing furunculosis and carbuncles.

With regard to pulmonary conditions, to select only one example the results obtained in the treatment of lung abscess have been most impressive. Dieker reporting recently a series of 32 unselected cases, concluded that short-wave therapy in pulmonary abscess is the least violent of all treatments, and, with proper selection of material and careful technique, promises better results than other methods of treatment, including surgery. These conclusions have been amply confirmed by the results of other authorities.

On p. 208 of this issue, Justina Wilson gives a clear account of the outstanding results obtained from short-wave therapy in gynæcological conditions.

In various manifestations of rheumatism the advantages the method offers are too well-known to readers to require reiteration.

Finally, the recent application of short-wave therapy to the production of artificial hyperpyrexia for such diseases as gonorrhœal arthritis, syphilis, dementia paralytica, tabes dorsalis, and chorea, and the striking results often obtained in these conditions, must be mentioned.

With regard to apparatus, notable improvements have been made during the last few years. Thanks to the constant research of manufacturers, both in this country and abroad, the short-wave apparatus of to-day has reached a very high standard of efficiency, safety, reliability and ease of control, so that any practitioner without special experience can employ it with the optimal hope of successful results.

Any doubts which were harboured originally as to the permanence of short-wave therapy as a therapeutic procedure must surely by now have been dissipated, and undoubtedly many further useful applications for this physiotherapeutic method will be found in the future.

ULTRA-SHORT WAVE TREATMENT IN GYNÆCOLOGY

By Dr. JUSTINA WILSON, F.R.C.P., D.M.R.E.

LONG observation of the ills of woman-kind force the conclusion that inflammatory diseases of the pelvis are the chief factors in chronic invalidism.

The abdomino-pelvic pain and backache, the vague and rather obscure pains associated with headache, the toxæmia and mental depression, the dysmenorrhœa, menstrual irregularities, and often the sterility that accompany these chronic infections, and mar women's lives, are only too well known to gynæcologists and general practitioners.

During the last year or two there has been a strong trend towards adopting conservative measures rather than resorting to frequently repeated surgical operations which are often without success.

TREATMENT BY HEAT AND REST

Heat and rest have always been the first line of defence in the treatment of pelvic inflammation. Treatment by means of heat goes back as far as 450 B.C. when Hippocrates, the first physician to give systematic consideration to the diseases of women, laid down certain fundamental principles, which still hold good; one of these concerned the administration of heat by hot douches. Then douching fell into abeyance, to be discovered centuries later by Galen. After that womankind fell upon evil days; the sufferings of women were of small account in the Moslem world, where the law of Mohammed forbade male investigation or interference.

Throughout the Middle Ages gynæcology languished till ultimately, at the end of the seventeenth century, German physicians began once more to realise the importance of prolonged heating, which they effected in their own forceful and barbaric manner by pouring heated shot into the vagina.

DOUCHING

Some years later long hot douching once more came into its own. The method has undoubted benefits, namely: (1) The relief of pain; (2) absorption of inflammatory exudate; and (3) improvement of uterine circulation. Vaginal douching is useful provided it is administered with skill, and with raised pelvis, and that it ensures a well-maintained degree of heat applied to the pelvic organs, efficient pressure, and distension of the vaginal vault.

All nurses, however, do not seem capable of this meticulous technique, and in some cases douching may be a two-edged sword, as there is a risk of washing infection up through the cervical canal into the uterus.

Douching is contra-indicated also in those menopausal conditions where the cervical canal is patulous, or when it is soft and relaxed just before the menses; neither is it beneficial if mucus is scanty.

THE ELLIOTT BAG

Elliott-bag treatment in some respects represents an advance on douching. It consists of the use of a specially designed collapsed and distensible rubber bag with inflow and outflow tubes, which is inserted into the vagina, and lies round the cervix. The bag is filled with hot water, the temperature being controlled by a thermostat, and the temperature is gradually increased up to 130°F.; this causes a certain amount of hyperæmia in the vagina, uterus, and rectum, and a good deal less in the pelvic peritoneal cavity. It also brings about an increase in the leucocyte count, and profuse

discharge from the cervix is the immediate result.

The Elliott technique is of importance provided it is adapted to individual cases; it must be given slowly, and the patient closely watched afterwards for reaction; if this is severe, the treatment must be discontinued. Some patients are very intolerant of the distension produced, and sloughing and ulcerations have been known to occur.

Discernment must also be exercised in selecting suitable cases for the Elliott treatment; out-patients are, as a rule, less suited to conservative methods than are in-patients whose whole mode of life is comparatively under control.

It is also important in considering the use of the Elliott-bag to distinguish between post-abortive and gonococcal types of infection. In the former, streptococcal infection is common; these organisms penetrate the wall of the uterus, and extend into the pelvic connective tissues, often producing a hard mass with much induration, adherent not only to the uterine wall, but to the wall of the pelvis. With this infection we are apt to get dense masses of adhesions and some cyst formation. Patients who suffer thus are not suitable for Elliott treatment.

The best cases for it are those due to gonococcal infection. The gonococcus affects the tubes primarily, and the ovary and peritoneum secondarily, producing higher up in the pelvis much softer tubo-ovarian masses that do not blend with the uterine or pelvic wall.

Holden and Sovak report good results from the Elliott treatment, not only before operation, but as a post-operative measure. It rapidly removes the exudate and increases the vascularity of the tissues, and in several cases after Robin's test had indicated that the Fallopian tubes were occluded, their patency was restored by a course of Elliott treatment.

DIATHERMY

The favourable results achieved by the late Doctor Elkin Cumberbatch, and Dr. C. A. Robinson in England, and by Corben and O'Connor in America, with diathermy in the treatment of gonococcal urethritis and endocervicitis encouraged hopeful anticipation of its use in intra-pelvic infections, especially in adnexal disease of gonorrhœal origin.

Diathermy is the application to the body, by direct metallic contact with the skin, of high-frequency currents of low voltage, with a frequency of one million oscillations per second; its spread through the body is subject to the laws of Joule and Kirchoff; that is to say, strictly limited by tissue resistance and by the predilection of this current for paths of highest conductivity. It avoids the resistance of bone, fat, and other structures such as capsules and membranes which it fails to penetrate.

It is true that the passage of high-frequency currents produces heat in the body, but the distribution of heat is not controlled in diathermy where its production is in direct proportion to the square of the current, so that the high resistance of the skin and subcutaneous tissues may become dangerous, because undesirable amounts of heat may be produced there. So much energy is expended on overcoming their resistance that little is left to penetrate to deeper organs such as the inaccessible adnexa, wedged in as these are between bony and fatty masses, and close to the sensitive intestine.

There is no getting over this failure of diathermy to heat deep-seated pelvic tissues, so that as regards depth effect it is no improvement on the Elliott-bag treatment, and its usefulness in the pelvis is practically limited to the mucous membrane of the urethra and cervix. Even here the good it does is not always permanent.

Some twelve years ago the author treated a series of fifty cases of primary and recent gonorrhœal infection by urethral and cervical diathermy. A steady follow-up of these cases revealed the fact that tubal incidence was much larger as compared with other methods of treatment. In the cases in which tubal complications did not occur

it was found that diathermy caused a temporary improvement after fifteen to twenty treatments. The patients were then discharged, but all returned with recurrence and discharges within a year, and sometimes within a few months.

The best results of diathermy treatment were seen in the treatment of gonorrhœal arthritis, where urethral treatment only was given.

SHORT-WAVE THERAPY

To penetrate the intricate layers of the pelvic tissues and their imperfectly connected resistances and capacities another method had to be found. The problem was solved at Jena in 1926, when Esau and Schliephake succeeded in generating ultra-short high-frequency currents of ten to one hundred megalocycles, endowed with sufficient energy to penetrate all structures in the condenser field.

In this ultra-short wave high-frequency field with its frequencies of 10-100 million oscillations per second, the physical laws of Joule and Kirchoff no longer hold. The current, indeed, divides into two components; the current of conduction, and the current of capacity or displacement. Insulating layers such as glass, rubber, and the high resistance of bone, fat and fascia in the body completely stop the diathermy current which is compelled to pass them by, and to take the easier path by way of blood vessels and lymphatics. In the short-wave condenser field, on the other hand, this division of current enables the difficulty to be overcome, because electrical energy continues to pass through these tissues as the current of displacement, until all resistance is overcome, when it proceeds as the current of conduction.

This is the new and unique quality of ultra-short wave high-frequency currents, distinguishing them from diathermy, and enabling them to pass every obstacle and produce deep and homogeneous heating effects.

The enormous importance of this quality of ultra-short wave currents for penetrating the dense masses of the pelvis was at once realised by Continental gynæcologists.

In 1931, Raab in Berlin; and Wittenbeck and Wintz at the great Frauen Klinic in Erlangen; Vogt, Dalchau and others began to publish the results of short-wave treatment in inflammatory conditions of the pelvic organs. Reports from Erlangen were, however, discouraging at first, Wittenbeck pronouncing short-wave therapy to be "neither better, nor worse than diathemy." His bad results were due to the fact that the apparatus used at that time had much too low an output. When, however, Siemens produced a machine with a wattage of between 750 and 1,000 watts, and with shorter wave-lengths, rapid and permament cures were claimed, not only of tubal inflammation and adnexitis but of complications such as parametritis wth excessive infiltration, and pelvic cellulitis.

Diathermy has now been abandoned for pelvic work at Erlangen and in all the great Continental clinics, and it is the writer's experience, after twenty years of diathermy and five of short-wave therapy, that the latter is infinitely superior to diathermy in inflammatory disease of the pelvis. Whether these conditions are acute, subacute or chronic, the results of short-wave therapy are uniformly satisfactory, and, what is more, they are permanent, and the method can be applied without risk or fear in acute cases where diathermy is a danger, and where recurrence is all too common.

Biological Effects of Short-Wave Therapy

Much of the effect of short-wave therapy is due to the homogeneous nature of the hyperæmia which differs entirely from that of diathermy. To achieve this, a machine of adequate intensity is essential, with ultra-short waves of from 6 to at least 3 metres, and the electrodes must be large. Under these conditions the thick muscular and bony structures of the pelvis are penetrated with less danger from the high resistance of fatty tissues, provided the dielectric is wide.

Under the influence of this deep and homogeneous heating the dense hardness of the vaginal vault softens as the exudates disappear, and cicatricial tissues and adhesions become stretched, more vascular, and thinner.

Short-wave therapy alters the permeability of cell membranes, stimulates the circulation throughout the part treated, and greatly increases the speed at which blood corpuscles travel through the capillaries. Thus tension is reduced and pain relieved as inflammatory exudates are absorbed.

In the whole of the area of inflammation the vitalising effect of this deep hyperæmia becomes evident as its defensive forces are raised to aid the organism in its fight against infection. With the resolution of inflammation and the restoration of circulation in the congested tissues there is also that marked improvement in the patient's general condition which is such a noticeable feature of short-wave therapy. It seems to start a regenerative process throughout the whole organism that shows itself by improvement in skin, hair, and muscle tone. Appetite is increased, and there is a gain in weight. Patients sleep better, and soon lose the fatigue, irritability, and depression that so often accompany chronic pelvic disease.

Hyperæmia is not the only effect achieved by short-wave therapy. Its effect on the sympathetic nervous system and, through that, on the endocrine system is of outstanding importance.

There has been much controversy regarding other so-called "specific" effects of this remarkable form of therapy. These are not yet understood, or scientifically proved, and, until the difficulties of dosage and standardisation of experimental conditions are overcome, the problem of specificity must for the present remain unsolved.

Technique

Results of short-wave therapy depend much on technique, that is to say, on the position of the part treated in the condenser field, on the concentration of the current throughout that part, and on the electrodes, their nature, size and position.

For pelvic work glass-shod metallic electrodes should be used, with a wide air-space. Rubber and felt absorb too much energy, and are not suitable for deep work. In placing electrodes it is important to get all the organs of the true pelvis—bladder, uterus, adnexa, and parametric tissues—into the condenser field. The best method is to use two large dorso-ventral electrodes of about 18 cm. diameter, the ventral electrode completely covering the pelvis, and the dorsal electrode protruding below the coccyx. A very common fault is to place the dorsal electrode much too high up in the lumbar region so that the electrical field only reaches the upper part of the organs.

Three conditions are necessary for depth effect. Both electrodes should be placed at equal distances from the body, both should be of equal size; and concentration of the current on any prominent part should be avoided.

Position of Patient

The patient should lie on a couch on her sound side, the side to be treated being uppermost, in order to avoid concentration on the posterior electrode, or else in the supine position on the Erlangen (or other suitable) couch—of latticed wood—with one electrode behind the sacrum and the other behind the flexed thighs. Failing this, a canvas deck-chair does very well.

DOSAGE

A practical, simple, and exact dosemeter will soon be produced in England; few people know of it as yet, and so far dosage has been roughly worked out on time and skin electrode distance. Over-dosage should be strictly avoided in acute cases,

especially in acute pyosalpinx in which there is always risk of perforation. In all acute and subacute cases it is well to begin with short treatments, of five minutes, with distances of ten to fifteen millimetres. Strong treatments at this stage invariably produce pain.

Energy output should be kept low, and only the mildest degree of warmth should be experienced. But dosage must always be an individual matter for each case, and must depend on the patient's reaction. Daily treatments, with an occasional rest, are given, and the time is increased carefully up to 15 or 20 minutes. After ten days the treatment is given three times a week.

In chronic cases the dosage is higher. These cases need heat, and should begin with 10 minutes' treatment, which may be given daily, and can be prolonged to 30 minutes. The energy output is higher, because it is sometimes necessary to give a slight temporary stimulation to a chronic condition, and thus to initiate the stage of healing.

One great experience has been gained by short-wave therapy, namely that the improvement begins soon after the inception of treatment and continues long after it has ceased, and that it leads to healing which is complete and permanent.

Indications

The chief indications for short-wave therapy in gynæcology are inflammatory tumours of the adnexa, adnexitis, parametritis, and pelvic cellulitis. The immediate result of its analgesic and antispasmodic qualities is freedom from pain, and this occurs after one or two treatments; then improvement in all subjective symptoms occurs, and there is a definite fall in temperature after two or three treatments. In recent cases of adnexal tumours, diminution occurs early, and by degrees all inflammatory exudate is absorbed. Of 6 cases of acute pyosalpinx, in which operation seemed inevitable, and in which short-wave therapy was merely being employed as a preliminary method, it was found that in 4 of these the inflammation had subsided so well that operation could be avoided entirely. In the other 2 cases the inflammatory process became localised, and the operation was performed without difficulty or danger. Short-wave therapy had definitely improved the conditions for it.

Subacute Cases

During the past year over 60 cases of adnexa disease in the subacute stage were treated by short-wave therapy. In most of these, cervical smears proved the presence of the gonococcus; in the others, the positive reaction was not given, but many pus cells were present, and in all cases there were subacute cellulitis and endocervicitis. The chief symptom on admission was abdomino-pelvic pain on one or both sides, and the temperatures ranged from 90-100.2° F. The degree of pelvic involvement varied considerably. In 10 of the cases there were semi-thickened tubes, very tender, and painful; in 5 cases of abortion there were large tubo-ovarian masses, usually on one side, with smaller swellings on the other side. Most of these were due to initial adnexal infection; some were cases of acute exacerbation of a chronic inflammation. All of these cases were treated by the usual abdomino-sacral technique. It is rarely necessary to treat the cervical canal, but in a few cases where this was desirable, a few ionization treatments with zinc or copper were given with good results.

The most satisfactory cases were those that suffered from a first attack of gonorrhœal adnexal inflammation; in all of these the pelvic mass disappeared; patients were entirely relieved of all symptoms in a comparatively short time (fourteen to fifteen treatments), and showed striking improvement in their general health. In 4 cases the symptoms cleared, but the adnexal mass persisted on palpation; these were operated on successfully, and their convalescence was very much more rapid than is usually the case.

Chronic Cases

Dosage here is more difficult, and athermic treatment practically useless; only medical judgment and experience can solve the problem of giving enough heat to stimulate the healing process without overdoing it and breaking down Nature's own defence mechanism.

Prognosis in chronic cases depends on whether the condition is mainly the result of inflammation, or due to the presence of hyperplastic cicatricial tissue, chronic induration, and adhesions which drag on, and deform the tubes, and cause much pain. In the latter cases short-wave therapy alone cannot effect a cure.

It is sometimes almost impossible at a first examination to decide which of these elements is the predominant factor. If in doubt, it is wiser not to proceed at once to operation, but to give a course of about 6 to 12 short-wave treatments first. Although this may not replace ultimate operation, it never causes any damage, and always results in a much clearer picture being formed of the true condition in the pelvis. It removes some inflammatory pelvic adhesions, and much swelling and chronic stasis, after which it is easy to recognize hard cellular exudate and the board-like masses that one finds in the region of the broad ligaments, as well as larger cyst-like accumulations of fluid that only operation can remove. The operative findings in patients who have had this preparatory short-wave treatment compare very well with those who have not had it. The pelvic structures are found to be softened by hyperæmia, adhesions are less thick, and fibrous, and more easily removed; wound infection is practically unknown, and post-operative convalescence of these patients is remarkably free from pain, distension, and other complications.

Where the inflammatory factor is predominant, the results of short-wave therapy in chronic cases are most satisfactory; acute symptoms rapidly subside, and a course of 12 to 18 treatments very often results in complete disappearance of any trace of a tubo-ovarian mass, or else in so much reduction that it can hardly be felt as a palpable structure.

Two recently treated cases of chronic pelvic inflammation following appendicitis, may be of interest:

1. *B. C.* A young woman married two years; first seen in consultation with a well-known gynæcologist, September 23rd, 1938. She was suffering from sterility, and complained of very severe dysmenorrhœa, especially marked on the first, third and fourth days of the periods, which were irregular—now early, now late—and very much too profuse. There was no vaginal discharge, and micturition was normal. The patient gave a history of an acute appendix two years previously, after which the abdomen had been drained for three weeks. On examination there was a left tubo-ovarian mass the size of a large orange, which was extremely tender; the uterus was retroverted, and fixed; there were many adhesions to the left of, and posterior to, the uterus. In the right fornix there was some swelling. Ultra-short wave treatment started at once, and the patient was seen again by the gynæcologist, after ten treatments, on November 1st, 1938; the left mass was found to be very much reduced, but still palpable, and the patient had had one menstrual period with very severe pain. Eight more short-wave treatments were given. She reported on March 6th, 1939: "Very little pain at December period; none during January or February." On examination, the pelvis was found to be "absolutely normal." The period on February 22nd was the last; on April 4th a six weeks' pregnancy was diagnosed. The uterus was still retroverted and fixed. On May 31st a twelve weeks' pregnancy was found, and the uterus was in its natural position.

The points in this case were the following:

1. The initial severe pelvic infection, so severe that nothing short of laparotomy could have been considered if short-wave treatment had failed.
2. The severe menstrual pain after treatment began. (This is a very common occurrence, and the patient should be warned about it).
3. The great relief of pain during subsequent periods.

4 The fact that further improvement occurred in the pelvis for at least two months after short-wave treatment had stopped, the maximum effect not being obtained till then.

S. T. A young married woman of 34, seen in consultation with the same gynæcologist. She complained of chronic pain in left side, severe dysmenorrhœa and sterility. Past history showed pelvic pains of long standing, ever since appendicectomy twelve years ago. The operation had been very severe, and drainage had to be continued for some time. On examination, the uterus was much enlarged, and a large tubo-ovarian mass was found on the left side, with many adhesions, fixing the ovary to the pelvic wall and to the uterus. There was considerable cellulitis and a smaller swelling on the right side. The mass on the left was so extensive that nothing short of laparotomy seemed possible. It was, however, decided to give short-wave treatment a chance. Before this was begun a dilatation with glycerine drain was done, followed by a week's rest in bed. The period then came on with much pain. After that, short-wave therapy was begun, and after 12 treatments she was seen again by the gynæcologist, who found the pelvis absolutely clear, with only a very slight vaginal discharge, which cleared up after the next period. The patient's general health was enormously improved. One hopes that in this case also sterility will be conquered.

No mention has been made in this paper of the general or hyperthermia treatment of gonococcal disease, by which many cases have been entirely and rapidly cured. This treatment is best given by air conditioning methods, such as the Kettering apparatus.

PHYSIOTHERAPY IN DISEASES OF THE SKIN
(PART II)

By ROBERT AITKEN, M.D., F.R.C.P.

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Erythema Pernio

ERYTHEMA PERNIO is a condition in which one gets as a rule excellent results from irradiation. Soon after treatment is begun the itching becomes less and the lesions gradually subside and disappear. General treatment is the best for this condition.

Erythrocyanosis Crurum Feminarum

Erythrocyanosis crurum feminarum is a condition which has become common during the years since the War. At first the lesions were observed just above the ankles, but as skirts became shorter the condition became more extensive and lesions were observed well up the leg towards the knee. While the cause is not known, there is no doubt that cold plays an important part in the production of the disease. Under general radiation treatment the general circulation is improved and the large cold chilblain-like lesions on the legs disappear, while the appearance of the skin becomes more normal. All treatment is useless, however, if the patient persists in wearing thin stockings.

Pityriasis Rosea

Pityriasis rosea is a condition which clears up in six weeks or so without treatment. Appropriate treatment can shorten the duration to about four weeks. This result can be brought about also by irradiation. A brisk dose producing definite erythema and exfoliation is required, but it is doubtful if the amount of time saved is worth the discomfort to which the patient is necessarily subjected.

Cutaneous Ulcers

Varicose ulcers, trophic ulcers, X-ray ulcers and bedsores all are stimulated to heal as the result of local light treatment, but small doses must be given except in the case of varicose ulcer. In the other conditions considerable damage may result if a brisk reaction is produced.

Dermatitis Herpetiformis

Dermatitis herpetiformis is not a common condition in general practice, though a considerable number of cases is seen in a large dermatological clinic. Light baths are of the utmost value in this disease. Arsenic is the only other remedy which seems to control the eruption. This drug must, however, be stopped intermittently, and it is at this time that light treatment is so valuable. Sometimes, however, irradiations do not help. I recently had two cases of this condition in my wards. In one case arsenic was of no value, but light baths controlled the eruption. In the other, radiations did not help, whereas arsenic did.

Leucodermia

Leucodermia, in my experience, is not benefited by light baths. I have actually shielded the surrounding skin and painted the white patch with eau-de-Cologne before irradiating in order to produce a brisk reaction, and yet after seven and a half months' treatment there was no sign of pigment even microscopically. Kromayer[1] states that pigmentation occurs irregularly and that the disfigurement resulting from light treatment is worse than the original disfigurement of the disease.

It cannot be too strongly insisted that conditions which clear up satisfactorily in a short time under other treatments ought not to be treated with ultra-violet rays. Impetigo contagiosa, for example, clears up in a week or ten days if proper treatment is given and the instructions carefully carried out. Light treatment will not bring about a cure in less time, and it is not fair to the patient to use a more expensive remedy when a less expensive one will cure the condition as quickly or more quickly. In the same way, to suggest ultra-violet irradiation for the treatment of scabies, as has been done seriously by medical men, is to bring the method into disrepute.

Photo-Dynamic Action of Certain Drugs

Certain risks attend light treatment, and in view of the increasing use of certain drugs, the attendant risks ought to be better known. I[2] have already pointed out the risk of giving light treatment to patients who have recently had gold injections. Hallam[3] refers to the risk in connection with the sulphanilamide preparations. Eidinow[4] argues against Hallam's view and suggests that it was the drug itself which gave rise to the toxic eruption. Hallam is unlikely to have made such a mistake, and consequently, until further experience is gained, it behoves doctors to exercise the utmost caution if they give light treatment to patients who have had one of these drugs.

X-ray therapy is probably the most valuable single remedy which a skin specialist possesses but here again indiscriminate use cannot be justified. Recently, for example, I saw a patient who had a self-inflicted eruption on the face, and who had been given several X-ray treatments for it by a radiologist who was ignorant of the true nature of the skin condition. No amount of X-ray treatment will cure a dermatitis autophytica, and the treatment ought not to have been administered. Such indiscriminate use can only lead to actions for malpractice.

1. KROMAYER (1930). *Cosmetic Treatment of Skin Complaints.*
2. AITKEN, R. (1930). *Ultra-Violet Radiations and their Uses.*
3. HALLAM (1939) *Brit. Med. J.*, 1, 559.
4. EIDINOW, A. (1939). *Brit. Med. J.*, 1, 692.

The field of usefulness of X-rays in diseases of the skin is so wide that it will be possible only to deal with the more common conditions such as are most usually seen by the family doctor.

Ringworm of the Scalp

Ringworm of the scalp is not so common now as it was 15 years ago, but it is of the utmost importance because of its duration apart from epilation treatment—and its effect on the child's education. Thallium epilation has to some extent displaced X-ray treatment, but thallium has its risks and its limitations, and I believe that X-ray epilation in suitable hands is the best treatment, thallium being reserved for children who are too young to remain still for X-ray treatment. I may say in passing that the joint pains which may follow the administration of thallium may be mistaken for acute rheumatism, and I have known of children being admitted to hospitals for acute rheumatism who were really suffering from the joint symptoms following the administration of thallium. This point in the differential diagnosis does not seem to be mentioned in medical text-books, or to have attracted the attention of physicians generally.

The administration of an epilating dose of X-rays according to the Kienbock-Adamson technique is the treatment of choice. I would refuse to undertake the care of a case of ringworm of the scalp where consent to epilate the head was not given. It must be remembered, however, that X-rays will not cure the disease. They merely remove a mechanical obstacle to the application of the antiseptic ointment which is the curative agent.

It is sometimes stated that ultra-violet rays will cure ringworm of the scalp. No definite evidence has been produced in support of this statement, and all dermatological evidence is against it. Dermatologists have not infrequently had to treat with X-rays or thallium cases of ringworm of the scalp which were supposed to have been cured with ultra-violet irradiation.

There is, however, one use for ultra-violet rays in ringworm of the scalp and that is in diagnosis. Ultra-violet light filtered through Wood's glass is a valuable aid in the diagnosis of small-spore ringworm. The affected hairs fluoresce brilliantly. This method ought not to be relied on implicitly, but should be used in conjunction with clinical and microscopic examination. It is valueless in the case of large-spore ringworm, as, owing to the spores being inside the hairs, fluorescence does not occur. If, therefore, this method is used exclusively, mistakes are liable to occur.

Favus of the scalp is so uncommon now that it need hardly be mentioned, but X-ray epilation is essential in this disease.

Acne Vulgaris

Acne vulgaris is a condition which may be very distressing to the patient. Ultra-violet irradiation is sometimes recommended for it, but the results are not satisfactory. Exfoliating doses must be given, and the same result can be obtained by using a peeling paste. One advantage of the paste is that greater control over the reaction can be exercised. Even when exfoliating doses are given the ultimate result may be poor. One of the worse cases of acne I have ever seen was that of a young lady who had had brisk ultra-violet treatment only a few months previously. X-ray treatment is more satisfactory. It is useful in all forms of the disease, though hardly justifiable in the mild cases. In the more severe cases, especially in acne indurata, it is useful and indeed is the remedy of choice. In the more severe cases bad scarring follows the eruption, and, to prevent this disfigurement, X-ray treatment should be instituted early. The dose is 150 *r* every fortnight for four doses. Care must be taken to protect the eyebrows. One course is as a rule sufficient, but there may be a recurrence when a second course has to be given. Needless to say, strict attention must be paid to diet, as all forms of

treatment are of little value if the patient indulges in the rich diet which is so harmful in this disease.

Malignant Disease of the Skin

Carcinoma of the skin is not uncommon either as rodent ulcer or as a squamous-celled epithelioma. In rodent ulcer the results of irradiation are far superior to those obtained with other forms of treatment. In the case of rodent ulcer—still too frequently excised—the percentage of cures after excision is only 40 to 45. After radiation therapy—either X-rays or radium—the percentage of cures amounts to 80 to 90. If the cases were seen early enough this percentage could be considerably raised. McKee[5] gives statistics which show 91 per cent. of cures. The figures he quotes concern unselected cases in which in many instances the patients were unable to attend for various reasons to have second or third treatments. If these patients were omitted from the statistics, the cures would be in the neighbourhood of 96 to 98 per cent. These figures show what can be done for rodent ulcer by modern dermatological treatment; yet, incidentally, I do not remember seeing a dermatologist's name on any of the Committees dealing with cancer under the Government's new Cancer Scheme.

A certain number of recurrences take place and these occur as a rule during the first year. These generally respond satisfactorily to further X-ray treatment.

Formerly small doses at weekly intervals were given, but the method has now been abandoned, and large doses are now favoured. The dose may be given at one sitting, or it may be divided, but the treatments are given in such a manner that a massive dose is administered. The small rodent ulcer, of 1 cm or less in size, is given 300 *r* unfiltered every second or third day till a total of 1,500 to 1,800 *r* has been administered. It is, of course, important that the apparently healthy skin beyond the lesion be also treated. I ordinarily shield the skin to within 1 cm. of the visible or palpable edge of the lesion. If the lesions are larger, heavier doses must be given, and, if there is much infiltration, it is better to use a filter. Treatments are given every second or third day, 200 to 300 *r* being administered through 2 to 3 mm. of aluminium, until a total of 3,000 *r* has been given, or even 4,000 *r* if there is much infiltration.

There is still a difference of opinion as to whether the results obtained with radium are better than those obtained with X-rays. Sometimes a rodent ulcer will fail to respond to X-ray therapy, yet will clear up under radium. McKee and his co-workers have shown what can be accomplished with gamma rays which could not be done with X-rays.

It may be a matter of convenient to use radium in certain cases, and the choice is a matter of convenience. In some situations radon may be employed with advantage. I have not found satisfactory results with X-ray treatment of rodent ulcer along the edge of the lid. It is impossible to apply a plaque in this region. Radium needles may be used, but I find radon seeds convenient and satisfactory in this situation. Radon seeds of 1 mc. at the time of using are inserted at distances of 1 cm. at right angles to the lid margin. These are left in for a week. The results are excellent both from the viewpoint of cure and of cosmetic appearances.

There is one situation where radiation treatment is not satisfactory. The uneven surface of the ear prevents rays getting at the under-surface which may be diseased. For rodent ulcers in this situation I find the best treatment is to use an ethyl chloride spray to anæsthetize the part, and then to scrape away the diseased tissue with a sharp spoon, the forefinger of the left hand being employed to palpate the ear as much as possible. After the bleeding has been stopped, the surface is cauterized with fused chromic acid. If the scraping is done thoroughly right to the edges of the lesion, the results are excellent.

5. MACKEE (1938). *X-Rays and Radium Treatment of Diseases of the Skin.* 3rd edit.

Squamous-celled epithelioma is more serious than rodent ulcer. No matter how early is the stage of the lesion we cannot be certain that glandular metastasis has not already occurred, even though the glands are not palpable. This makes it essential that the glands draining the area should also be treated, and it is customary to irradiate the glands whether the primary growth has been irradiated or excised. Tumours vary in their degree of radiosensitivity even when of the same morphological type. Small tumours may fail to respond, while inoperable and apparently hopeless cases may be clinically cured and remain well for years.

An early squamous-celled carcinoma of the skin, if less than 1 cm. in size, may be treated with one massive dose of 2,000 to 3,000 *r* provided that there has not been any previous treatment. If the tumour is larger, a heavier dose with filtration must be given. Through 3 mm. aluminium, 200 *r* each day may be given till a total of 4,000 to 6,000 *r* has been reached. If previous treatment has been given, the daily amount ought to be less, and the time over which the treatment is administered prolonged. In this way severe damage to the skin and underlying tissues is avoided or minimized.

Radium may be used instead of X-rays. The application may be in contact with the part or at a distance. Radon seeds may be employed instead of the plaque. Seeds containing 1 mc. of radon for each square cm. of the carcinoma are placed in, around, and under the lesion. One cm. of healthy tissue must be included in the treated area.

Carcinoma of the lip is less serious than most carcinomas of the skin and mucous membranes, and consequently there is an excellent prospect of a cure, if the diagnosis is made early. If palpable glands are present, the outlook is more serious. If X-rays are given, the technique is similar to that already outlined for early skin carcinoma, 2,000 to 3,000 *r* being given in doses of 300 *r* on alternate days. If the lesion is more infiltrated and larger, radon implantation with filtered radiation ought to be employed. The glands in the neck must also be irradiated.

Intraoral carcinoma does not often come for treatment to the skin specialist, and so need hardly be discussed.

There is one type of skin cancer which the dermatologist sees and which can be dealt with easily. Prolonged X-ray treatment of lupus [illegible] skin conditions occasionally gives rise to carcinoma. This can attain conside[illegible]sions without the glands being [illegible]ed. A dense fibrous tissue barrier [illegible]e cancer, and this blocks the [illegible] I have not yet seen such a ca[illegible]sfactorily with X-rays. Rad[illegible] but the best results are [illegible] surgical treatment. The area [illegible] and the carcinom[illegible] sharp spoon. The diseased tissue com[illegible]asily from the und[illegible]e. Care must be taken to scrape thord[illegible]ght to the edges of th[illegible] bleeding has been stopped, the raw [illegible] is cauterized with fused cr[illegible] acid.

Warts

Warts in their different forms are very common. They are mysterious lesions, sometimes clearing up with simple remedies, at other times proving very stubborn, and almost baffling all one's therapeutic resources.

The ordinary wart, verruca vulgaris, has, as a rule, had a variety of treatments before the skin specialist sees it. If there is only one lesion, or a few isolated ones, these may be given a dose of X-rays of 600 *r*, the skin being shielded to the edge of the lesion. If there are numerous warts, it is not possible to treat them in this way as such a dose would damage the skin. To cut a hole in protective tissue for each wart is hardly feasible. Under these circumstances it is advisable to give 300 *r*, and repeat the dose in four weeks if necessary, but more than three doses should not be given on account of the risk to the skin. If there are warts on both hands, it is occasionally found that by X-raying one hand the warts on the other hand also clear up.

Carbon dioxide snow may be used if there are only one or two warts, but the application must be long enough to cause the wart to be lifted up by the blister which follows. If this does not occur the wart is not really influenced by the treatment. Firm pressure for 60 seconds is required, and the snow should come right down to the skin at the edge of the wart.

Diathermy may be used for this condition. Large warts may have some anæsthetic injected before the diathermy needle is applied. It is better not to go too deep with the diathermy needle, but rather to repeat the application a week or ten days later. If the warts are numerous, it is necessary to treat them in batches, or to give the patient a general anæsthetic if it is intended to treat them all at one sitting. Turrell[6] suggests an indirect diathermy, making the patient one plate of a condenser. A pointed instrument, such as a needle for small warts or a pointed pair of artery forceps, is held in the hand of the operator without wires being attached to it. The application is then made to the patient thus charged up with electricity. The current surges to-and-fro between the operator and the patient, and the wart is burned away both from the under-surface and the upper part. Turrell states that this method is almost painless, but I find that patients do not agree with this.

Instead of diathermy the spark from the pointed vacuum-electrode of a high-frequency apparatus may be used, but I find that this is not so satisfactory as the diathermy method.

Sometimes the wart is along the side of the nail and tends to grow in under the nail. The nail should be pared properly back and the diathermy given without an anæsthetic. The tissues are dense in this region and the pressure exerted by the injection may damage them and delay the healing or even cause suppuration.

Verruca plana, the flat wart found usually in children though not exclusively so, generally occurs in large numbers on the face or hands. X-rays frequently fail to influence the condition. If this treatment is persisted in, it only results in damage to the skin. The best plan is to touch each wart momentarily with the diathermy needle.

Plantar warts give rise to more discomfort than their appearance suggests. It is the pain which as a rule makes the patient seek advice. X-ray treatment gives excellent results, 600 *r* being given to the lesion. Not infrequently the pain begins to abate in a few days, and the lesion flakes off in a month or little more. If it does not, another dose of X-rays may be given six weeks after the first dose. Diathermy may be used in this condition also, the part being anæsthetized before the needle is applied.

Keloid

Keloid not infrequently follows burns though it may be a sequel to any injury or operation. It may be rather disfiguring. Too frequently it is excised, and a recurrence inevitably takes place. Sometimes, after excision has been practised, X-ray treatment is given to the new scar. It is difficult to see any justification for this procedure. If the keloid is large, extensive skin grafting would be necessary. If the keloid is small the difference between the new scar and the keloid treated with X-rays cannot be great, and a much better cosmetic appearance would be the only justification for surgical intervention followed by X-rays.

I remember a patient who came to the Skin Department of the Royal Infirmary some years ago. He had been vaccinated during his war service and keloid developed. This was excised and presently recurred in an aggravated degree. Unfortunately he fell into the hands of another surgeon who excised the keloid, and the inevitable recurrence took place, again in a much aggravated form. When he was seen in the Royal

6. TURRELL, W. J. (1929). *The Principles of Electrotherapy.* 2nd edit.

Infirmary he had a large ugly lesion with numerous projecting promontories. A paraffin-wax cast was made of the condition at this stage. The painting of the cast was left till the patient's next visit a fortnight later, as there would not be any change in the colour of the lesion. After the taking of the mould for the cast he was given a dose of X-rays. When he returned to have the cast painted it was interesting to observe the improvement. With the cast alongside the patient's arm it was easy to notice how the whole lesion had flattened and how the promontories were retracting. The difference between the result of surgical treatment and X-ray treatment greatly impressed the patient.

If the condition were recognized earlier, the treatment would have better results as early keloids respond more satisfactorily than fully developed ones. If the keloid is very large and thick, it is hardly possible to expect it to clear up under X-ray treatment without some atrophy and telangiectasis. If the keloid is widespread and not thick it will often flatten to the level of the surrounding skin with proper irradiation. Doses of 225 *r* may be given at intervals of four weeks, the normal skin being protected to the edge of the lesion. If the condition has not cleared up after eight treatments it is not likely to improve with further treatment.

Radium may be used instead of X-rays, but there is little difference in the results.

For smaller lesions CO_2 snow may be used, the application being made for 60 seconds with firm pressure and repeated when the reaction has passed off. In the case of the larger lesions the CO_2 snow treatment may be used after the greater part of the keloid has been reduced with X-rays, but it must be remembered that the skin is more responsive to snow after X-ray treatment, and a considerably shorter application made. Some writers do not approve of CO_2 snow treatment for keloid, saying that there is as great a risk of recurrence as after surgical treatment, but this has not been my experience.

Acne Keloid

Acne keloid is a condition which is seen on the back of the neck in men. It is a bad name as the condition has no connection with acne. The other name, dermatitis papillaris capillitii, is perhaps cumbersome, but is more accurate. The condition primarily consists of papules at the follicular orifices. Pustulation develops, and also keloidal growths which may attain considerable size. The condition is rebellious to ordinary treatment, but responds to X-rays. Doses of 150 *r* at intervals of a fortnight, or 225 *r* at monthly intervals, will bring about satisfactory results in the early stages. In the later stages more treatment is required, and is liable to cause permanent baldness over the affected area. As the disease itself, however, causes permanent baldness, the risk of X-ray alopecia need not be too seriously considered.

SOME EXAMPLES OF DIATHERMY AND SHORT-WAVE APPARATUS

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Continuing the Series of Papers on
ELECTRO-MEDICAL APPARATUS : ITS CHARACTER, OPERATION AND CARE: PART II. No. 10 (continued)

APPARATUS FOR X-RAY WORK

Introduction

A VISITOR to an up-to-date radiological department of any fair-sized hospital would see an impressive display of apparatus comprising X-ray tubes complete with stands to permit convenient irradiation of any desired part of the body, components of X-ray machines, couches on which the patient may rest, equipment for screen manipulation in visual work, neat and efficient control switchboards, and appliances for photographic developing and printing.

The plant is often disposed in different rooms devoted to special work such as diagnostic radiography, X-ray treatment, dental work and the like with specifically desiged installations for each service.

The contrast between the orderly array of modern apparatus and its counterpart of but twenty years ago is striking. Present-day plant is arranged for accessibility, safety, mobility and speed of operation, but all honour is due to those who in the past, with primitive appliances, produced results which paved the way towards the realization in radiology of an instrument which has reached an advanced stage of development in the medical sphere.

It is the purpose of the present and subsequent papers in this series to explain the function and operation of the various devices which go to make up the X-ray machine and to refer briefly to some of the auxiliary appliances used in diagnostic and treatment technique. The subject is a wide one, and the writer has dealt with it at some length elsewhere* in a treatise on electrical equipment for X-ray work in medicine and industry, but only such matters will be presented which have particular interest to medical users of X-rays.

Essentials of X-ray Plant

Röntgen discovered X-rays in 1895 when making investigations into the phenomena attending electrical discharges in rarefied gases. He was using a Crookes (or Hittorf) tube, a pear-shaped glass vessel with a flat disc-like electrode sealed into the small end to serve as a cathode and a rod sealed into one side to serve as an anode. A difference of potential was applied across these electrodes, the appliance used for this purpose being an induction coil.

X-rays are generated by the impact of electrons on an anode target. In early X-ray generators, such as the Röntgen tubes, the electrons were produced by the ionization of the residual gases in the tube after most of the air had been withdrawn. A high potential difference was employed, which not only produced adequate ionization, but gave to the electrons high speeds of travel towards the positively charged anode.

For a number of years " gas-tubes " (as they were called) were developed on the principles which characterised the apparatus used by Röntgen, but nevertheless the discharge current was erratic and difficult to control. In the modern tube the anode

*Electrical Engineering in Radiology. Chapman & Hall.

target and the cathode are enclosed in a vessel generally of glass and exhausted of air, the cathode being heated to produce a copious supply of electrons. The enclosing envelope may take any convenient shape, but it is generally cylindrical or spherical with cylindrical arms.

The X-ray generator is commonly called an X-ray tube, but is sometimes referred to as a lamp. The latter name is no doubt attributable to the fact that the envelope is illuminated within. In the early cold-cathode gas tubes the illumination was due to the bluish glow or gas discharge, while in the modern tube it is due to the heating of the filament.

For ordinary X-ray work the essentials are (1) an X-ray tube and (2) a source of electricity having a high potential difference. The positive pole of the source is connected to the anode of the tube and the negative pole to the cathode.

It is not easy to obtain a source of direct electric current with a high potential difference and of adequate capacity without recourse to transformers and rectifiers. In the old days the " transformers " were induction coils supplied from direct current, and these coils were used with gas valves to permit the current to pass only in one direction round the X-ray tube circuit. Later, alternating current transformers were used, the transformation ratio from supply voltage to secondary voltage being arranged to apply the required potential difference across the tube.

The transformer is a piece of apparatus, more reliable in operation, easier to control and, in general cases, more efficient than the coil, but the high potential generated in its secondary is of alternating polarity, so that, unless the anode of the tube to be energized be maintained at a low temperature, a device is necessary to suppress or invert the half waves whose polarity is opposite to that required on the tube. The early gas rectifying valves frequently used with induction coils were not well suited to transformers and so the mechanical rectifier was adopted.

For many years mechanical rectifiers were employed with transformers, but they have now been superseded by thermionic rectifiers or valves. A simple circuit for an X-ray transformer and tube is shown in Fig. 163.

In some X-ray apparatus the independent rectifier is dispensed with and the X-ray tube is employed as its own rectifier, but this entails e[illegible] that the anode is kept very cool.

The use in the modern X-ray tube of a hot filame[illegible]ode means that an auxiliary cathode heating circuit has to be provided[illegible]hand the arrest of electron flight at the anode means that energy has to [illegible] therefore anode co[illegible]ts are necessary. These [illegible]ether with the phenomen[illegible]ated with the various conditions of tube operation and maintenance will be described in later pages.

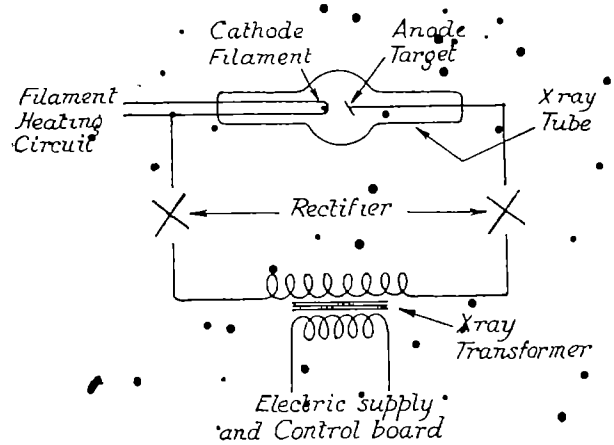


Fig. 163.—Elementary circuit of X-ray tube energised by transformer.

The X-ray Tube

Brief mention has already been made of the first tubes used for generating X-rays, and, while it is not necessary to expand the purely historic treatment of the subject, a few paragraphs will be devoted to the tracing of progress from the original devices used in radiology to the safe and efficient models of to-day.

The Hot-Filament Cathode

The introduction in 1913 of the Lilienfeld tube in Germany and the Coolidge tube in America, each employing an incandescent source of electrons at the cathode, marked a vital step in the development of the X-ray tube, particularly in respect of stability of performance and ease of control (Fig. 164). Since that time the old gas tube has gradually but completely disappeared from medical radiography.

Anode Cooling-Devices

With the demand for increase of radiographic power came the necessity for higher tube currents, and therefore effective cooling of the anode which receives the bombardment of the electron stream. Cooling may be effected by the use of metal radiators or with the help of water circulated within the body of the anode by thermo-syphon or pump (Fig. 165). Many improvements in anode design to obtain more efficient use of cooling water have been made, while pumping and water transmitting auxiliaries have been developed on rugged lines.

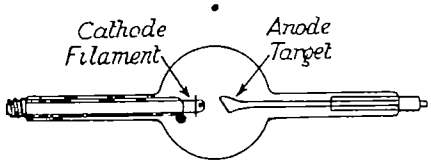


Fig. 164.—Diagrammatic representation of Coolidge X-ray tube.

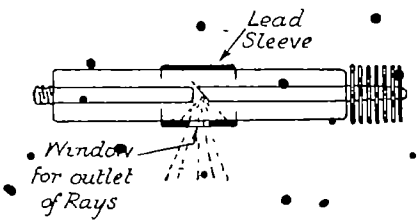


Fig. 166.—X-ray tube with lead sleeve surrounding region of origin of the rays. The anode and cathode also play a part in restricting the beam. X-ray beam shown by dotted lines.

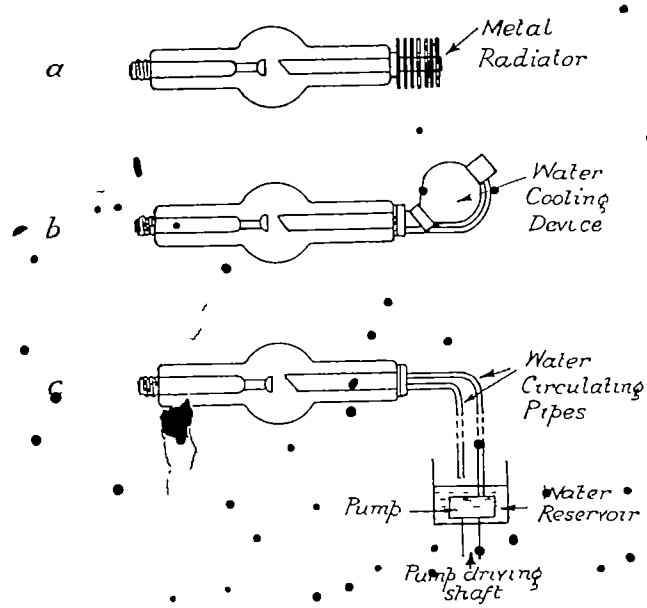


Fig. 165.—Diagrammatic views showing various methods of anode cooling. X-ray tubes with (a) metal radiator, (b) small water reservoir mounted on tube, (c) cooling water circulated by independent pump.

X-ray Safety

Since the bombardment of the anode by electrons gives rise to X-radiation in all directions, methods of preventing the escape, except at a properly provided aperture, of the X-rays then engaged attention, and so X-ray tubes were housed in ray-proof or partially ray-proof materials during use. Thus lead and lead-glass tube holders were adopted for Coolidge tubes.

The next important step in tube design following up the advances due to controllable cathode electron emission was the provision of ray-proof screens as an integral part of the tube itself, and thus lead bands with suitable windows were employed to surround the region from which the rays were emitted. (Fig. 166.) The first tube of this type, made by Messrs. Philips, of Holland, was demonstrated in London in 1923.

Meanwhile experimental tubes were being produced in commercial and other laboratories.

In 1928, Messrs. Philips marketed the " Metalix," a self protected tube, in which the protective lead band was mounted on a chrome iron sleeve sealed into the glass which formed the tube envelope. The use of ray-protected tubes eliminated the danger from extraneous main X-irradiation so that the operator had only to protect himself from scattered radiation coming from the object under examination.

Electrical Safety

The X-ray tube, however, was still a possible source of electrical danger since it had to be connected at its ends to a high voltage generator. The question of electrical safety, therefore, was next tackled. Of course, suitable precautions regarding clearance distances between the tube (as well as all other high voltage apparatus) and the patient and operator had hitherto permitted X-ray work to be carried on quite safely in the hands of authorized personnel, but it was felt that apparatus free from all danger would encourage the wider use of X-ray methods in every sphere and lend confidence where this was lacking.

The Victor Corporation of America marketed, for dental radiology, Coolidge's design for a complete X-ray tube and transformer outfit, oil-immersed in an earthed container, and thus secured simultaneously, by this means, safety from unwanted radiation (with the help of suitable lead barriers) and also from electrical danger. This apparatus was small though of ample output for its work, and it became the forerunner of a range of X-ray machines, designed on the same principle, for every medical application; diagnostic (fluoroscopy and radiography) and deep therapy.

Another way of affording electrical safety was to enclose the tube in a metal shield, which could be earthed, and to introduce into this shield earthed sheathed cables from the high voltage transformer in such a way that the transformer tank, cable sheath and tube shield provided a complete earthed envelope for all parts of the high voltage circuit. (Fig. 167).

In 1928, Messrs. Philips brought out a portable apparatus of this type, and since that time X-ray plant for every requirement has been designed and produced on similar lines.

The record of progress in the design of the X-ray tube shows, therefore, that the erratic performance of the gas tube has given place to the reliable running of the hot cathode tube, the dangers of general radiation from the " plain " tube have been eliminated by the restriction of the rays to a beam of known size and direction, while the risk of contact with electrodes at high potential has been removed by enveloping the tube in an earthed metal case integral with it.

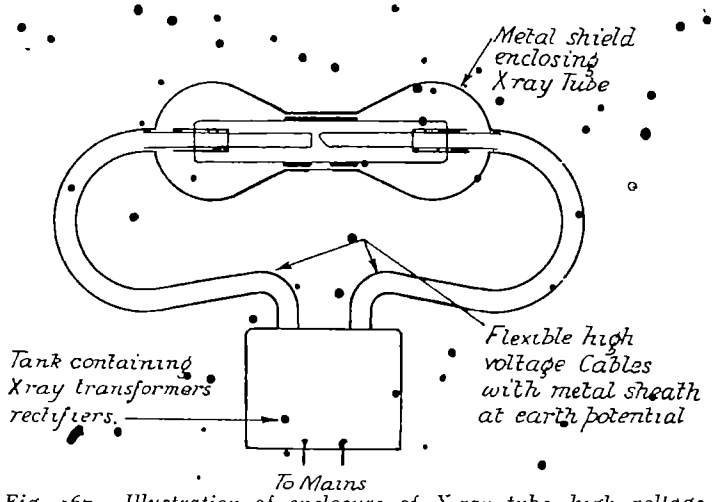

Metal shield enclosing X ray Tube
Flexible high voltage Cables with metal sheath at earth potential
Tank containing X ray transformers rectifiers.
To Mains

Fig. 167.—Illustration of enclosure of X-ray tube, high voltage cables and high voltage generator in leather sheathing for electrical safety.

Next month some examples of modern X-ray tubes will be described.

description and the two photographs which are given, the apparatus consists of a generator resembling in outward appearance a short-wave apparatus, but of the internal arrangement of this instrument no particulars are given. The two output terminals of this appliance are connected respectively to a "diffuser consisting of a series of separated concentric oscillating circuits connected with one another by silk threads."

By this means it is claimed, though no evidence is adduced to support the claim, that all wave-lengths from 10 cm. to 400 metres are obtained, and in addition it is asserted that the harmonics, "together with their fundamental waves, interference waves and effluvia, may extend as far as the infra-red and visible light regions." Judging from the photographs of these diffusers in action, the effects produced would appear to be those of brush discharges, most diffused on the lower and earth side of the vertically placed diffuser and more concentrated at its upper extremity. This brush discharge only appears to emanate from the outer concentric ring of the diffuser. The treatment is applied by placing the patient between the two diffusers, which are separated from each other by four or five feet.

The cases for which successful results are claimed include rodent ulcer, naevi, epitheliomata, goitre and gastric ulcer. The photographs given of the results obtained in the treatment of rodent ulcer closely resemble those obtained from surgical diathermy, and it is possible that a powerful brush discharge might account for the benefits received. Lakhovsky, however, claims, in addition, improved cosmetic effects that would delight any Beauty Parlour: referring to a photograph of a case of epithelioma of the left cheek in an old lady of 82, it is stated "it will be observed that not only has the tumour completely disappeared, but that the skin shows distinct signs of rejuvenation, as evidenced by the smoothed-out wrinkles in the face and neck."

As not infrequently happens, when a writer is unable to explain in simple language the issue under discussion, he attempts to veil his ignorance and obscure the subject further by the introduction of meaningless terms and theories. Lakhovsky has adopted the term "Universion," which he defines as the "synthesis of the infinitely great and the infinitely small. Universion consists of the entire plexus of cosmic radiations emanating from interplanetary space." On the basis of Universion Lakhovsky evolves a theory to explain the migration of birds and the problems of instinct and special sense in animals and insects.

The absurdity of the author's deductions and conclusions becomes most apparent when he deals with bacteriology. In an earlier work, *La Cabale,* Lakhovsky complained that he had "been attacked by physicists ignorant of biology, and by biologists ignorant of physics, who consequently can neither understand my theories nor judge my experiments." Bacteriologists might complain with far greater reason that their established views have been attacked by one entirely ignorant of bacteriology and biology. Lakhovsky considers that the organism consists only of what he terms "living Biomagnomobile Units." He defines a biomagnomobile unit as "the elementary units of living organisms, as molecules and atoms make up chemical substances."

He employs the term "to stress their biological origin, their essential mobility, and the electromagnetic element which charges them with vital energy." He arrives at the conclusion that all functional activity can only take place when the general organization of the cells is in harmony with the oscillations in the nuclei, and that the energy necessary for the cellular oscillation is supplied in the first place by cosmic radiation. He next proceeds to ask, "What about toxins?"

To this question he supplies the remarkable answer. "Toxins are the waste products of cells and of dead microbes. As they are no longer living, and thus constitute inert matter, these waste products neutralize the oscillatory movement of neighbouring cells and weaken them or cause their destruction. These inert particles attract living particles: in any case their proximity modifies the electrical capacity of living cells which can no longer oscillate in accordance with their specific frequency; hence disease or death" Finally, Lakhovsky sums up his conclusions as follows: "Life is created by radiation, maintained by radiation, destroyed by oscillatory disequilibrium."

Lakhovsky deals at considerable length with the nature, causation, and treatment of cancer. On the preventive side, he is "convinced that if people could subsist exclusively on fruits and vegetables grown in gardens attached to their houses, and made use of water drawn from wells sunk close by, cancer and most other diseases would become far less prevalent."

He is further of the opinion that the immunity to cancer might be still further increased

by wearing metal plates in one's shoes and by fixing radio-electrical antennæ outside one's house.

In the appendix, a somewhat violent and uncalled for attack is made by the translator upon radium treatment, and harrowing details of the sufferings of a famous surgeon are given; these might well have been omitted.

A stop-press notice in large type, which attributes the recovery of the late Pope from his penultimate illness to the application of Lakhovsky's Multiple Wave Oscillator, concludes this remarkable book.

Summary. What conclusions can we draw from these two views, so differently expressed, but having some underlying points in common? The more restrained and scientific approach to the subject by Sir James Mackenzie will enlist the sympathy and attention of investigators to a greater extent than the wild and irrational views expressed by Lakhovsky.

We are led to conclude that in the simplest form of life, such as the amœba, the vital processes of the protoplasm would be influenced by such extrinsic agents as radiant heat, ultra-violet radiation, etc., and possibly also, but certainly not entirely, by cosmic radiation.

As the organism developed into a more specialized and complex system, endogenous stimuli, resulting from the electro-chemical processes within the body, would furnish the cell impulse for which Sir James Mackenzie was seeking. But nevertheless the exogenous stimuli, such as cold, heat, ultra-violet radiation, and possibly cosmic rays, would continue to influence the organism, however specialized and highly developed it might become.

In this connection, the late Dr. Sontag's article, "Discussion on the Vagus and Sympathetic Nerves in relation to Climate and Hydrology," is of special interest. In this paper Sontag demonstrates how cutaneous stimuli pass by way of the vagus and sympathetic nerves to the various organs, through the sympathetic nerves to the cutaneous blood vessels and endocrine glands, setting up changes in the cutaneous arterioles, which in turn produce changes of an opposite character in the viscera. The automatic or endogenous activity of internal organs can be affected in many ways by the extrinsic or exogenous stimuli acting through the vagus and sympathetic nerves, and Sontag held that the effects of climate and baths are partly or entirely due to such impressions.

To the chemical and electro-chemical stimuli of cells we must add mechanical stimuli, implying tension, traction and arrest of kinetic energy, and its transformation into heat energy.

Examples of the effect of such stimuli are demonstrated by Professor Adrian's experiments on the action currents in nerves produced by mechanical stimulation of sensory nerve endings. By means of an extremely delicate electrometer capable of reacting to a potential variation of 0.01 millivolt lasting for 1/1,000 of a second, Adrian was able to record the passage of action currents "accompanying afferent impulses in the sciatic nerve of the frog when the gastrocnemius is stretched by a weight, in the cat's saphenous nerve when the skin is pinched, in the vagus of the cat and the rabbit when the lungs are inflated, and in the cardiac depressor nerve of the rabbit with each heart beat."

These points are of far more than mere academic interest to electrotherapists, for they serve to explain the reflex action of the galvanic current and the static charge and breeze on the cutaneous nerve endings, and the manner in which muscle tonus is re-established by Morton Smart's method of graduated muscular contraction. Moreover, a further study of these problems should lead to a clearer exposition of the primary mechanical or dynamic action of high-frequency currents apart from their secondary thermal effects.

It is evident that visualization, free from dogmatism, is essential for the inspiration that must precede productive research. But we should realize that, when dealing with such a controversial subject as the "Secret of Life," that, as a distinguished writer has recently remarked, in reference to another problem, we are "concerned with matters on which certainty is unattainable, conjecture is irresistible and ingenuity at a premium."

W. J. T.

Corrections.

It has been pointed out to us that the statement in the *Journal* for July, page 193, that Edinburgh Royal Infirmary was the only hospital in the British Isles to possess 3 Finsen-Lomhold Lamps is incorrect, and that the London Hospital, E.1, possesses and uses 3 such lamps, and is installing 4 more as soon as they can be obtained.

The quotation, given on page 178 *ante*, from a paper read by Dr. W. J. Turrell before the Physical Medicine Section of the British Medical Association in 1936, should have extended to the end of the paragraph following that printed in small type.

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

A New Apparatus for Treating Peripheral Thrombosis, etc.

Early stages of peripheral thrombosis of the veins of the leg are characterized by slight œdema around the internal malleolus, especially in the space between the tendo Achilles and the tibia. This is soon followed by pain on pressure over the muscles of the calf, a symptom which can be demonstrated by pressure applied over the deep vessels of the limb. Passive dorsiflexion of the foot is found to be painful, and all these signs found together are characteristic of early thrombosis, and should therefore receive immediate treatment. It is, of course, unnecessary that all the signs should be present in this characteristic way, but a few of them, together with the history, will be sufficient for the experienced observer to make a diagnosis, and accordingly start treatment which is of great importance, as the danger of embolism is to be remembered.

Payr (*Munch. med. woch.*, 1939, 86, 586) studied the anatomy of this problem, and he came to the conclusion that the plantar venous net was the most likely site of origin of stasis and thrombosis, on account of its extremely rich net of small vessels. The peripheral anastomosis between the great saphenous vein and the deep veins of the leg increased that danger in the author's view.

Further to the above characteristic signs of thrombosis in early stages, many patients complain of characteristic spontaneous pain in the soles of the feet. This mainly occurs in those persons who stand much, and who have varicose veins or a predisposition to them.

On walking, these veins are compressed by the muscles, and the blood pressed out of them; but in those confined to bed this healthy circle is interrupted, and therefore, after operations or accidents, and chiefly in the puerperium, the absence of this healthy circle is widely felt. The temperature of the skin is raised.

Payr evolved an ingenious little device to counteract stasis in patients suffering from these conditions. In order to stimulate circulation in the lower extremities, he devised a wooden roller which is placed transversely at the foot of the bed. The patient is then instructed to rotate this roller, using the muscles of the sole, as in carrying out walking movements. This "walk in bed" was carried out on every patient in Payr's clinic, and the result was a steady diminution of post-operative complications; furthermore, the patients were interested in having something to do.

A stimulating feeling of fitness follows these therapeutic exercises, and the symptoms of early thrombosis soon disappear. In patients who underwent this treatment on account of foot tiredness, the pains in the soles diminished in intensity and disappeared after a certain period of treatment. Patients suffering from varicose veins were subjected to this additional measure of exercise, and even in pes planus the results were quite encouraging. Arthritis deformans and gout were other conditions in which this method was further tried out with complete success.

There are a large number of conditions predisposing and causing pain in the feet. Therefore, the author contends, this method should be given the widest possible use, as it will be found of great benefit in counteracting stasis.

Chronic œdema of the legs in cardiac patients also reacted favourably to this method of treatment.

X-ray Therapy in Otolaryngological Infections

A. F. Tyler (*Arch. Phys. Ther.*, 1939, 20, 295) summarizes present knowledge on the treatment of infections of the throat and ear by X-rays. Hypertrophied, acute and chronic infected tonsils, for instance, are benefited by irradiation, though the disadvantage is that three or more sittings are required, as against the single procedure of tonsillectomy. It is to be noted that the results from radiotherapy are not immediately apparent; a few months are usually necessary to demonstrate the excellent results which can be achieved in expert hands. The advantages of the method are that it does not require hospitalization or anæsthesia, and has no mortality or side-effects whatsoever. Large septic tonsils with pyrexia subside within 24 hours after irradiation.

Acute and chronic infections of the nasal antra are also treated by irradiation, and the results published have been very encouraging. The results are due to the radio-sensitivity of the lymphoid structures of the hypertrophied membrane and the lymphocytes which are broken down and thus liberate bacteriolysins activate the macrophages to greater bactericidal activity. This destruction of the lymphocytes can be demonstrated on the second or third day of treatment.

In early nasal polyposis good results have been observed; in old cases the results were very poor. In 100 cases of acute mastoiditis in which radiotherapy was employed, 64 were cured, the rest either not being radiosensitive or having been so far advanced that surgery was necessary.

The dosage required in otological conditions was 75 to 100 r once or twice daily in acute conditions, or once or twice weekly in chronic infections.

Aconitine Iontophoresis in the Treatment of Rheumatism

The use of aconitine in the treatment of rheumatism was studied and tried out by M. Barakin (*Ann. med. Phys. de la Rheum.*, 1939, 32, 125), who came to the conclusion that it had a markedly beneficial effect in many cases. A 1 per cent. solution of the alkaloid was used, with a current of 2.5 mA., iontophoresis was continued for half an hour each time. It is important to place the active electrode at the periphery of the affected part or limb, in order to act on the terminal nervous junctions. The author tried out this method in six cases, and the findings therefrom were most encouraging. The pain diminished after the first treatment, and the patients stated that they felt a pleasant languor and lightness after the treatment. This, in the author's view, was due to the analgesic action of the alkaloid locally. Œdema disappeared completely under iontophoresis with aconitine. The circulation was much improved, and existing cyanosis soon disappeared. In a few cases an antispasmodic action was also observed. The authors conclude that there is a good case for further trial of this method.

X-ray Treatment of Rheumatic Diseases

In the treatment of rheumatic disease small doses of gamma rays are used. The dose is from 50 r to 100 r, which is about 5 to 10 per cent. of the surface erythemal skin dose. Intervals of 4 to 7 days are observed between treatments, and a course lasts 6 to 8 weeks. An interval of another 6 to 8 weeks may be followed by a second and third course of treatment. There are many reports on successful radiotherapy of toxic and septic arthritis, but the advent of sulphanilamide has superseded radiotherapy in all these cases.

The modern method of radiotherapy of rheumatic conditions is by "wide-field" irradiation. This method was introduced by Gilbert Scott, who was the first to advocate general surface irradiation. The treatment was originally designed for the therapy of asthma and bronchitis, but successful "side effects" led to its use in rheumatism. A broad focus X-ray tube, operating at 150 kilovolts, is used, and 80 r are applied to an area of 5 to 10 square inches. A filter of 0.5 mm. copper and 1 mm. aluminium is used. Scott claims that cases of rheumatoid arthritis call for treatment of the whole body, and that no benefit can be expected from the irradiation of a single joint. Wide-field irradiation gives relief of pain, and effects a true constitutional change. Wide-field irradiation is a new technique in X-ray therapy; its value may be over-estimated, but it is certainly beneficial in the treatment of rheumatic conditions. The author, A. Eidinow (*Brit. Journ. Rheum.*, 1939, 2, 13), concludes by saying that larger doses of X-rays are hardly useful.

Evaluation of the Thin-Window Bactericidal Lamp

A. Fisher (*Penn. Med. J.*, 1939, 42, 910) used a thin-window bactericidal lamp emitting rays rich in bactericidal wave-lengths in cases of pyodermias and fungous diseases. There were no irritating symptoms, and little pigmentation resulted from the treatment. The effect of the light on tinea capitis, paronychia, perleche and infected varicose ulcers was very encouraging, apart from a few cases which did not respond to any other previous treatment. The effect on impetigo, tinea corporis and infected incisions was also noteworthy; in echthyma and pruriginous dermatophytoses of the feet and inguinoscrotal dermatitis it proved to be a very valuable therapeutic agent.

The number of cases treated was very small, but even so the author concluded that there was justification in publishing the results, as they should encourage further trial.

A POWERFUL AID IN

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The stimulating properties of ultra-violet light can be usefully enhanced by a physiological tonic such as

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Short-Wave Therapy in the Treatment of Lung Abscess

The results of short-wave treatment in 32 unselected cases of lung abscess are described by W. Dieker (*Fortschr. Rontgenstr.*, 1939, March, 193). Many of the patients were extremely ill, and indeed a few were beyond surgical aid. Short-wave therapy was so favourable in these cases that no surgical help was required at all The author used the Siemen's apparatus, working at 6-metres wave-length and with Schliephake's glass electrodes. On patients who could only be treated in bed, rubber electrodes were used with layers of perforated felt pads. Daily treatment lasted from 5 to 20 minutes. The lungs were constantly controlled by X-rays. Lung abscesses larger than a man's fist were successfully treated. Defective delimitation of the abscess, transition into gangrene, pyrexia, or a bad general condition did not delay treatment. The author concludes that short-wave therapy in lung abscess is a non-violent treatment which gives better results than many more drastic procedures. Simultaneous empyema makes short-wave therapy more difficult, and should be therefore previously drained. Statistics have shown that the purely conservative treatment of lung abscess has a mortality of 75 per cent. This is one more reason for trying short waves in this very critical condition.

Short-Wave Therapy of Pyogenic Infections of the Head and Neck

W. J. Egan (*Arch. Phys. Ther.*, 1939, 20, 331) treated 98 cases of pyogenic infection of the face, neck and head with ultra-short waves. In his opinion and experience this form of therapy is far superior to any of the existing heat applications, as it has an excellent effect on the lymphatic system. As there is a very rich lymphatic net-work in the face and neck, this affinity may explain the excellent results obtained.

Infra-red Photography in the Diagnosis of Vascular Tumours

Infra-red photography is now 6 years old, and it has already been widely used in medicine, mainly in dermatology. F. Ronnhese (*Arch. Phys. Ther.*, 1939, 20, 354) suggests its practical value in the diagnosis of hidden varicosities, invisible veins and vascular growths hidden under a normal skin. In the differential diagnosis from other similar conditions this method is of great practical importance.

REVIEWS of BOOKS on Physical Medicine and Allied Subjects

Manipulative Surgery

Treatment by Manipulation in General and Consulting Practice. By A. G. Timbrell Fisher, M.C., M.B., Ch.B., F.R.C.S. (Eng.). 256 pages, 68 illus. Price 12s. 6d. London, 1939. H. K. Lewis & Co., Ltd.

This monograph by Mr. A. G. Timbrell Fisher has now reached a third edition, which has been extensively revised.

The book opens with a brief chapter on the history of Osteopathy and Manipulative Surgery and a second chapter, new to this edition, is entitled "The Cult of Osteopathy." The author comments on the increasing interest in Manipulative Surgery taken by the medical profession. He rightly points out that, so long as unqualified practice in this field persists, it is the duty of the medical man to do all in his power to safeguard the public.

Chapter II outlines the principles of Osteopathy, and refers to the findings of the Select Committee of the House of Lords appointed to consider the Osteopaths Bill. It provides just those facts that the physician should be able to put before his patients if need be. Next are chapters on the pathology of conditions amenable to manipulative treatment, and on adhesions. Though brief, this section serves as an introduction to the remainder of the book, which deals with treatment. Each region of the body is dealt with separately, and each section opens with a description of normal joint-movements. The study of normal joint-movements has been much neglected in the past, and we can recommend Mr. Timbrell Fisher's observations and diagrams to those interested in manipulation. We think, however, that certain forced movements which can be obtained deserve more attention. For example, the antero-posterior gliding of the tibia on the femur with the knee in the semi-flexed position is most important. The accounts of the manipulations of the individual joints are comprehensive and easily followed, and well illustrated with photographs. The value of photographs in a book of this kind is great, and, in spite of the cost of reproduction, we like to see a well-illustrated book.

The final chapter, "Notes on After-treatment," we found a little disappointing. The author emphasises the importance of a detailed knowledge of the methods of physical medicine for those practicing manipulative surgery, and we think that, in a book which should appeal to senior students and house surgeons, there should be at least a brief mention of such methods as ionisation, faradic muscular contractions and diathermy. A short chapter on these lines might do something to cure that scandal of all massage departments, the patient from another department with a request for "massage and movements, please."

Treatment by Manipulation is well produced and easy to read, and we can recommend it to medical men and to students of physical medicine. W.E.T.

Artificial Fever Treatment

Pyrétothérapie. By Charles Richet, Jean Surmont, et Pierre Le Gô. 195 pp., 28 illus. Price 50 francs. Paris, 1938: Masson et Cie.

This fine monograph by Professor Charles Richet, bearer of a name highly honoured among physiologists, and two specialist members of the Paris school, is a timely and most welcome review of the present position of a subject which, ancient in origin, has recently made such strides in company with other branches of physical medicine. It is therefore appropriately, and gracefully, dedicated to Arsène d'Arsonval, "who created physiotherapy," and A. von Wagner-Jauregg, to whom we are indebted for malarial therapy. The occasional beneficial influence of one disease on another, for example, of an acute febrile infection on a chronic disorder, has long been recognized, and fever, like inflammation and often with it, regarded as a defensive reaction. But full advantage and application to practice of this scattered knowledge are comparatively recent advances. This concise presentation of a rapidly expanding subject begins with biological considerations, such as the effects of high temperature on bacteria and protozoa and then on the cells and tissues of higher organisms. The methods of inducing artificial pyrexia, their technique, and combinations are set out in clear and admirable detail. The untoward effects and contra-indications are frankly described, thus Richet mentions that, among 300 patients treated for very different diseases by artificial fever induced by sulfosin or by dmelcos, two died within three days of the injection. The third and last section of this valuable exposition is devoted to an account of the clinical results of the treatment in the

numerous diseases in which it has already been employed, either generally or locally. It is pointed out that in general paralysis of the insane, in acute or subacute arthritis, chorea, disseminated sclerosis, and some infections and nephroses, artificial fever is the best or the only curative treatment available. It is admitted that in some instances the mechanism of cure is not yet clear. The work of others is generously acknowledged, and there is a full bibliography of more than 150 items. H.R.

Physiology

Physiology in Medical Practice. By Hugh Morris, M.D., D.M.R.E. 276 pp., illus. Price 12s. 6d. London, 1939. Edward Arnold & Co.

This volume is intended for those practitioners who desire a greater knowledge of physical medicine so that they may prescribe it with intelligence; it is also for doctors who possess their own apparatus.

The subject matter is distributed as follows. 156 pages are devoted to *medical electricity,* and include an excellent chapter on physical principles. This section differs widely from the sections in other books in that there is a welcome wealth of illuminating diagrams. Most of us have visual memories and are aided by graphic representation of theories and facts; the book is unique in the manner in which the need is met for diagrams, well thought-out and executed.

Ultra-violet radiation claims about 50 pages. The history of u.v.r. is omitted, for which one may well be grateful, as in so many books too much valuable space is taken up by this subject. The physics of ultra-violet radiation are also omitted to a great extent, and, as the author says, "attention is mainly given to the effect of rays on the human body, to their production, and the manner of their application." The chapter in which treatment by ultra-violet irradiation is considered cannot be taken as specifying the only method, nor in some cases according to our opinion, the methods of choice. But it is sound and useful. Specialists vary in prescription and technique, and it has to be remembered that the field of treatment is still one of exploration.

A good chapter on *infra-red radiation* follows.

In the final two chapters, which are devoted to *"Diseases and their Treatment,"* the author deals with indications for treatment, choice of apparatus and technique.

It is to be hoped that readers will study the memorandum on *precautions against shock from electro-medical apparatus;* this important subject is too often neglected.

The full and well-expressed *glossary* adds to the value of the book, and it will help materially in the ease with which it can be read.

The *Index* is full, and also shows the wide field over which the author ranges. The book can be heartily recommended to those for whom it is intended. M.E.O.

Electrosurgery

Clinical Electrosurgery. By Gustavus M. Blech, G.C.S., G.C.G., M.D., LL.D. 389 pp., illus. Price 21s. London, 1939. Oxford University Press.

This book, as its Preface points out, is "for the purpose of acquainting general surgeons and such general practitioners who have occasion to perform operations, with the advantages, indications, limitations and clinical application of electrosurgical procedures."

These aims it very admirably fulfils. Theoretical considerations have been limited to a minimum consistent with an understanding of their practical application. A useful feature is the inclusion of an alphabetically arranged glossary proceeding the text; this is particularly valuable for those readers who are not familiar with electrophysics.

Another feature which should commend the book to those who do not specialize exclusively in electrotherapy is that only proved methods which are likely to be utilized in actual practice have been included, and a mass of experimental and other procedures of chiefly academic interest have been disregarded. The very wide experience of the author has been incorporated in this work.

The book is divided into two parts. Part 1 deals in a concise yet comprehensive manner with such subjects as historical development (a chapter contributed by H. A. Colwell), electrosurgical procedures, equipment, general technique, indications and limitations, nomenclature and radiotherapy of neoplasms (the latter contributed by B. W. Windeyer, Radiotherapist to the Middlesex Hospital, London, and H. A. Colwell).

Part 2 deals with electrosurgical operations, and includes those on the skin, head and spine, face and neck, thorax, abdomen, genito-urinary apparatus, female pelvis, the extremities, the nose, throat and larynx, and the eye.

This book should go far to removing the suspicion with which many surgeons to-day regard electrosurgery. It clearly indicates the types

of case in which electrosurgery can give really excellent results, and as clearly describes the limitations of the method. It should lead to a better understanding of the whole subject among general surgeons. If one could find a fault it would be that the book could be more fully illustrated. A.C.

Electro-Medical Apparatus

Electro-Medical Apparatus and Their Management. By W. E. Schall, B.Sc., F.Inst.P. Eighteenth Edition; 115 pp.; 168 illus. Price 7s. 6d. London: Schall & Son, Ltd.

This is the eighteenth edition of a book which first appeared in 1892, and was then written by the present author's father. The volume shows a first-hand knowledge of the machines described, as may be expected from the close connection of the author with their manufacture. He does not confine himself to practical details, but has included a considerable amount of the physics of electricity and radiation. In these sections the difficulty has clearly been that of selection and compression. If some sections had been treated fully, the book would have grown out of all proportion. This is particularly noticeable in the treatment of the oscillating valve. The intention is clearly to keep the subject simple and understandable without assuming any previous knowledge of valve characteristics. An intelligent student will probably suspect this, and will feel that the whole thing has been "made easy" for his benefit.

There are a number of small points which seem to have eluded the proof reader. There is a factor of 2π omitted from the formula on page 15, and the mobilities given on page 25 are velocities under unit potential gradient, i.e., 1 volt per cm. The term thermo-couple is used on page 22 for a bi-metallic strip, which is not the usual meaning of the term.

In general the book is well supplied with clear diagrams on a larger scale than in many handbooks, and the photographs of Schall apparatus give an accurate idea of the appearance of the machines. The author's standpoint is individual, and the book is not a collection of academic orthodoxies, but includes the results of much of the most recent work on atomic physics. So much is this the case that one feels that some statements will have to be modified in the nineteenth edition, because theory and experiment are produced so rapidly in atomic physics to-day that nobody has time to recant the heresies of yesterday. B. D. H. W.

CHIROPODY AS A MEDICAL AUXILIARY SERVICE

The recent recognition of chiropody by the British Medical Association, and its approval as an auxiliary medical service, is of interest to medical practitioners generally. The details of control and supervision of chiropody are delegated to the Board of Registration of Medical Auxiliaries, which is the co-ordinating body for all medical auxiliaries. A Chiropody Group Council has also been formed by the Board to act as the qualifying body for the control and regulation of the entry of chiropodists to the National Register of Medical Auxiliary Services, which is published by the Board.

In future, all chiropodists who satisfy the requirements of the Board will be enrolled by the Board, through the Group Council, and thus the public and the medical profession will be able through the published Register to enlist the services of a chiropodist whose training and ethical standards have been assessed and approved by the Board. The Board is convinced that, in order to recommend the public to place themselves in the hands of a chiropodist for treatment, such chiropodist should have received a course of training commensurate with the responsibility of treatment, and a minimum course of training of two academic years has, therefore, been laid down to allow for adequate clinical experience.

Prior to the official recognition of chiropody, no standardized course of training existed, there being offered to prospective students courses of training covering periods which varied from a few weeks to two years. Thus the public were unable to distinguish between a properly trained chiropodist and a person who, through no fault of his own, was allowed to set up in practice as a chiropodist by the granting of a diploma bestowed by an organization which, to say the least, savoured of commercialism.

The Register is supplied free to members of the medical profession, but members of the public may obtain it on payment of 2s. It is published by the Board of Registration of Medical Auxiliaries, British Medical Association House, Tavistock Square, London, W.C.1.

We regret that our review at page 205, *ante*, on Diathermy; Short-Wave Therapy, Inductothermy, Epithermy, edited by William Beaumont, M.R.C.S., L.R.C.P., did not contain the publisher's name. This is H. K. Lewis & Co., Ltd., and the price of the book is 10s. 6d. net.

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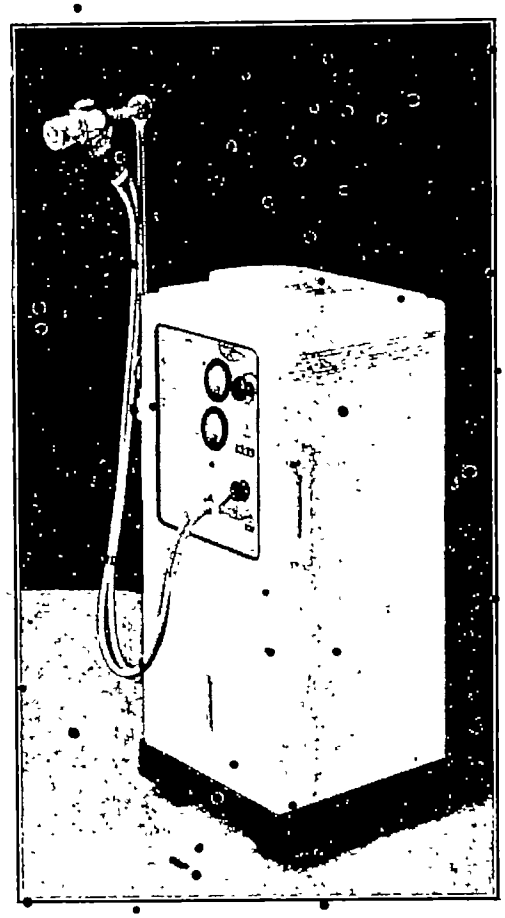
We have received from Messrs. Hanovia, Ltd, particulars of a new Kromayer Lamp (Model V). This is claimed to be a revolutionary advance upon any actinic sources hitherto available to the medical practitioner.

This new lamp functions on different principles to any previous type of Kromayer lamp. It operates freely and with equal intensity in any position—horizontally, vertically, or even upside down. Accordingly, the operator can utilize procedures which were hitherto impossible. Ultra-violet irradiation can be applied through the window, or along quartz applicators, to any accessible lesion, and have very short periods of application.

It possesses super-intensity, giving a contact erythema dose within 3 seconds, and a deep therapeutic reaction (fourth degree erythema, or blister dose) within 20 seconds. Its power is so great that the practitioner can select required wave lengths (using suitable filters) for any application, with ample reserves of energy.

The lamp embodies special provisions to ensure consistency and accuracy in dosage.

A large range of quartz applicators and glass filters are available for use with the new lamp, also a stop-watch for timing exposures. Full particulars are obtainable from the makers, Messrs. Hanovia, Ltd., Slough, Bucks.



SEASIDE HYDROTHERAPY CENTRE FOR LORD MAYOR TRELOAR CRIPPLES' HOSPITAL

Thanks to the generosity of Sir Alexander Maclean, who has made a gift of £100,000 to the Lord Mayor Treloar Cripples' Hospital, it is proposed to build a new hospital at Hayling Island, with therapeutic pools and sea-water baths designed on the latest scientific principles.

This great idea was conceived as a result of a visit to America in the company of Sir Henry Gauvain, Medical Superintendent of the Hospital. While investigating there the hydrotherapeutic treatment of infantile paralysis and other crippling conditions, they were so impressed by the advantages of this method of treatment that it was decided that British sufferers should have similar facilities.

When this new hospital is completed it will offer special hydrotherapeutic treatment to child patients from any hospital in the British Empire.

MEDICAL OFFICER'S ANNUAL REPORT FOR THE BOROUGH OF BERMONDSEY, 1938

We have received a copy of a "Report on the Sanitary Condition of the Borough of Bermondsey" for 1938, by the Medical Officer of Health. It is interesting to note the increase in the volume of the work done in the well-known Solarium during 1938. 400 more patients attended during the year, and nearly 17,000 more treatments were given. There was an increase of 2,000 treatments by massage. The total number of attendances for the year was 49,343, and the number of individual patients 2,102. The total number of treatments given was 99,111 during the year.

The nurses' room has been fitted with radiant-heat lamps, and a new room has been built for the nurses. The extra radiant-heat lamps have been a very great advantage, and many more patients have been able to have this as a preliminary to other forms of treatment.

The number of radiant-heat treatments given has been increased by 8,840.

Several diathermy and medical electricity machines have been added to the equipment. All this apparatus has been in constant use, with the result that diathermy treatments have increased by nearly 5,000, and medical electricity treatments by 2,595.

Patients are now able to have more frequent treatment, with the result that they do not need to attend for such long periods as formerly.

MEDICAL OFFICER'S ANNUAL REPORT FOR NOTTINGHAM, FOR 1938

During 1938, 873 cases were treated by ultra-violet therapy, i.e., 46 more cases than in 1937. Of these, 140 were brought forward from 1937, and 711 were discharged during 1938. The remaining 162 cases were carried forward to 1939. The total number of attendances during the year was 13,003 (i.e., 879 fewer than in 1937). This is accounted for by the shorter period of treatment prescribed for each case, viz., 0.98 months, as compared with 1.51 months in 1937.

The classification of cases, used in previous years, is found to be the most practical, and is as follows:

Group 1.—Cases of debility following acute illness; malnutrition and lack of muscular tone; cervical adenitis; anæmia; asthenia without apparent cause.

Group 2.—Nervous type; cases suffering from irritability, insomnia or disturbed sleep; habit spasms.

Group 3.—Cases of bronchitis and asthma.

Group 4.—General debility before or after removal of tonsils and adenoids.

Group 5.—Skin diseases; rheumatism.

As in previous years, more than half the cases fell under the heading of Group 1. Many parents whose children had previously benefited by the tonic effect of the ultra-violet rays applied at the clinics because their children were "below par" for varying reasons. Parents are frequently delighted at the beneficial effect of the treatment, and sometimes state that, after a few attendances, their children are "like different beings," having improved in appetite, sleep and energy.

The same apparatus that has been in use since ultra-violet therapy was started, viz., the carbon-arc lamp with iron-cored carbons, continues to give satisfactory results.

THE SOCIETY OF PHYSIOTHERAPISTS

The Massage Corps.

Following the announcement concerning the Massage Corps, published in the last issue of the *British Journal of Physical Medicine*, several further applications for enrolment forms have been received from members of the Society. The Executive Committee regrets that they have not been able to send enrolment forms to members, as the forms received from the Chartered Society of Massage and Medical Gymnastics for the enrolment of Bio-Physical Assistants are not, in the opinion of the Committee, worded suitably. The Committee has communicated further with the Chartered Society, and it is hoped that agreement concerning the amendments put forward will be reached at an early date.

Annual General Meeting

The Executive Committee is pleased to announce that Dr. William Beaumont will address members of the Society on the occasion of the Annual Meeting at the Langham Hotel, on Saturday, 28th October. Dr. William Beaumont, as many members will know, is Medical Director of the Institute of Ray Therapy, London, and Physician-in-Charge of the Physiotherapy Department of the new Westminster Hospital. He has also contributed a great deal to the literature on physiotherapy. The subject of his address will be announced later.

Full details of the Annual General Meeting will be posted to members well in advance of 28th October, but the Committee hopes that members will make a note of the date now and reserve it for the Annual Meeting, if possible. As was the case last year, following the Annual Meeting and the address by Dr. Beaumont, tea will be served for members and their friends.

Annual Dinner.

The Committee has now made arrangements for a Dinner to be held following the Annual Meeting and At Home. This will take place at 7.30 p.m. at the Langham Hotel, and the price of tickets for members and guests will be 9s. 6d. per head. Members are invited to remain for the dinner, which will be quite informal, if they can possibly manage to do so, as the occasion will enable them further to exchange their views with each other, and to discuss with the Committee matters brought forward at the Meeting in the afternoon.

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The Value of Combined Therapy Technique

Short-Wave Therapy and Eye Diseases

After-Treatment of Fractures

Ultra-Violet Irradiation in Skin Diseases

The Editor will be glad to consider articles from qualified practitioners, for inclusion in the Journal. Contributions of 1,000 or 2,000 words are preferred and should be addressed to the Editor at West Dean, Chichester, Sussex.

THE BRITISH JOURNAL OF PHYSICAL MEDICINE

SEPT.-OCT., 1939 *And International Review* Vol. 2. No. 9. New Series

Original articles are invited on any aspect of Physical Treatment. Such articles are published only on the understanding that they are contributed exclusively to this Journal, which does not hold itself responsible for statements made or opinions expressed by any contributor. The copyright of all articles appearing in the Journal is strictly reserved.

PHYSIOTHERAPY AND THE WAR

FOR the delay in publishing this issue of the *Journal,* we ask our readers' indulgence. Like so many other concerns, our organization has been temporarily upset by the sudden abnormal conditions arising from the national emergency, and we have therefore decided to publish the September and October issues together.

It is our intention, however, to carry on in as normal a manner as circumstances will permit, and to this end we would ask for the continued support and consideration of subscribers. The first effects of the state of war which has been thrust upon our country has led to a measure of paralysis in many business and other concerns, but this, we hope and believe, will prove to be only temporary. Life, industry, and the pursuit of knowledge must go on in spite of war. As Sir Samuel Hoare recently clearly indicated, it behoves us all to carry on in as nearly normal a fashion as is possible.

In so far as physical medicine itself is concerned, this should play an increasingly important part in alleviating and repairing the physical disabilities arising from war injuries. That it was of the greatest service in the war of 1914-18, and its aftermath, is well known. How much greater then should its value be now, in view of the many and important improvements in apparatus and in technique which have occurred during the last few years.

That many increases in knowledge will be made as a direct result of war experience is doubtless. Because of the vast amount of injury, and the many unusual forms in which it occurred, in the last war, surgery made great advances. For the same reason it may be expected that physiotherapy will make similar rapid advances as a result of the present war.

Apart from its use in the treatment of injuries and their side-effects, it is not difficult to visualize other important general applications which may be found for physiotherapy in war-time; for example, ultra-violet irradiation might reasonably be employed on a wider scale as a general tonic in subjects debilitated by war anxiety and a lowered level of nutrition, or perhaps for improving the physical status of recruits during training.

As always, this *Journal* will continue to present the newest developments of physical medicine, and, as in the past, will make every endeavour to further its wider use by the medical profession of Great Britain.

PHYSIOTHERAPY IN SUPPURATIVE SKIN LESIONS

By J. GRANT BONNIN, M.B., B.S., M.R.C.O.G., F.R.C.S. (Eng.)
First Assistant, Injury Clinic, West London Hospital.

THE treatment of superficial infections of the skin by physiotherapy, chiefly heat and cold, is as old as history itself, but recent advances in the field of radiation therapy have placed numerous wave lengths other than heat at our disposal, and, while the common foment or poultice is not forgotten, the benefits of more complicated therapy often is. While these benefits are based on similar physiological reactions to superficial heat, their area of action is not limited to the skin and the reflexes which may be called forth from it. Their effect is a deeper one, stimulating previously inaccessible tissues, due to a scientific defeat of the temperature-regulating mechanism of the skin.

It is quite certain that the use of heat in the first instance was not based on the recognition of the fact that local and general rise in temperature was one of the most important defence mechanisms of the body, but was based on the relief of pain. This is still one of the principal uses of physiotherapy in suppuration, and, while we are some way towards appreciating the increased metabolic activities produced by heat and their use in tissue defence, we are very little nearer knowing why pain is actually relieved. This relief is not related to the increased rate at which the lesion progresses towards a cure, though it may occur rapidly after a treatment, but more usually after the lapse of a period of hours. With the temporary instantaneous relief we are not here concerned.

The vast majority of suppurative lesions are of minor importance, and it would obviously give a needless amount of trouble to submit all to radiation therapy. Radiant heat in one or other form is readily available in the home, which has an electric radiator, or gas fire, and may be used in place of foments. Exposure at a comfortable distance for 10-15 minutes every two hours is as soothing as, and more effective than, equally frequent fomenting, though this latter is not to be despised. Much unnecessary condemnation of foments has been aroused by their incorrect usage. Foments should be applied only during the day, so as not to interfere with sleep, and in order to give the skin an opportunity of recovering from the sogginess that repeated fomenting induces. The surrounding normal skin should be smeared with a simple grease such as unguentum hydrarg. ammon. dil. The foment should be backed by a waterproof material, and then covered by a layer of cotton wool. Two-hourly application is necessary during the day and a dry dressing is applied at night. When, in spite of this, the skin assumes a water-logged condition, a dressing of magnesium sulphate and glycerine is applied.

Together with such treatment, correct general treatment must be applied. The patient must be suitably rested, which does not mean always confinement to bed, and the part placed locally at rest. Adequate diet, free fluids, and vitamins are given, combined with a course of chemotherapy. The general condition of the patient is investigated, and such conditions as diabetes mellitus, secondary anæmia, and chronic osteomyelitis, looked for, and treated. When this has been done the aid of physiotherapy may be sought; the following are the usual indications for the latter.

1. Failure of response to normal methods.
2. Recurrent cases.
3. Severe cases of carbuncle.
4. Excessive pain.
5. Lesions inaccessible to the usual methods, e.g., facial carbuncles and carbuncles in the external auditory meatus.

The actual rise of temperature of the treated tissues above that which could be produced naturally by increased blood flow is important, but more important is the vasodilatation which persists some time after the treatment has ceased. This is slowest in onset, but more persistent with X-rays, while it is most rapid in onset but transient, with radiant heat. Short-wave therapy lies midway between these, while ultra-violet light approaches radiant heat in its effects. Ultra-violet light is actually lethal to staphylococci, but this is not an important factor.

The common suppurative lesions produced by staphylococci, with which we are concerned, are folliculitis staphylogenica, furuncles, boils, and carbuncles, arranged in the common order of seriousness. One lesion may readily progress to another in the absence of proper care, progression being determined by the usual battle between the patient's resistance and the virulence of the organism. Folliculitis staphylogenica is generally a product of uncleanliness which, remedied, leads to a rapid cure. In these cases it is due to the *epidermococcus albus*, a normal skin-inhabitant which has become pathogenic. More serious trouble may arise from the ingrafting of a *staphylococcus pyogenes* infection on top of this, or in men whose work, for example, in cement factories, provides constant skin irritation. Such cases may be helped by the application of an erythema dose of ultra-violet light.

In furunculosis the general condition of the patient comes much more into the picture, and general physiotherapeutic measures should not be neglected. Fresh air and regular exercises may be combined with actinotherapy. Artificial helio-therapy is best given from the Alpine-sun lamp, and may be combined with radiant heat locally. Intense local actinotherapy, by concentrated arc-lamp irradiation on the granulation tissue, has little place or value, in our experience, in resolving boils. The Sollux lamp applied with a localiser and a red filter, in order to obtain deeper penetration, is of value in the incised boil to relieve pain and promote healing. The further treatment of furunculosis is similar to that for boils.

Resistant or recurrent boils are a source of concern to the patient on account of the pain and the time-consuming dressings, and to the doctor on account of the failure of the time-honoured remedies. Besides the general treatment already outlined, X-rays and short-wave therapy may also be utilized.

X-rays

Waves of medium penetration, or soft waves of the "Grenz" type, are used. With the usual apparatus voltages of from 100-150 kilo[illegible]ered with 1-5 mm. of aluminium are used, the dosage varying from 40-200 *r*. [illegible] dose is 90-110 *r*, or fifteen to twenty per cent. of the erythema dosage. [illegible]ition to an area well outside the lesion or lesions is given. A few work[illegible] followed it with a smaller dose in two days' time. The effects may be briefly [illegible] follows.

Incipient boils: The statement that these may be aborte[illegible]d with a certain amount of scepticism. It is a point difficult to prove. The [illegible]od when one boil is under treatment and another threatens to appear in the vici[illegible]ty, is almost the only opportunity one has of observing the early effects, and, if this is aborted, it is questionable if radiation can be given the credit.

Active boils: Pain is not as a rule rapidly relieved. Within a period of from 24-48 hours relief is usually felt, and this relief accompanies a general advance in the defence mechanism. The course of the condition is unaltered, but hastened, and incision is as frequently necessary.

Chronic resistant lesions: It is in this group of conditions that X-rays are most useful, as not only do they produce a vaso-dilatation of longer duration, but they also reduce the activity of sweat and sebaceous glands in the vicinity, which has much to do with the spread of the lesion in such sites as the axilla.

Short-wave Therapy

This has been used combined with X-rays in an endeavour to make use of both the rapid and delayed reactions. It is, however, a dangerous combination liable to lead to severe erythemas. The localised severe boil or carbuncle is best treated with short waves, which produce a rapid increase in the pain. In lesions which are spreading we believe that short-wave therapy is a powerful means of causing localization. A concave electrode is best as it leaves space for the swollen tissues, and its area must be considerably greater than the area required to be treated. A pleasantly intense warmth is aimed at, and this is maintained for 10–15 minutes daily. The rather optimistic views of Schliephake, based on the immediate success achieved by his treating a furuncle on his own nose in 1929, have been modified by ten years of experience, though we believe that short waves are the best physiotherapeutic adjuvant available. The discussion as to the length of wave used seems to be irrelevant, and not backed up by accurate observation. Wave lengths between 12 and 16 m. are satisfactory.

Incipient boils: The claim that it can abort an incipient boil has also been made for short-wave therapy. Such a point is very difficult to decide. The fact that a small infected follicle subsides without rupture does not necessarily mean that the pathological process has been aborted, but usually that it has been accelerated and liquefaction prevented by heat leading to dry absorption. We believe that this occurs, but the majority of such lesions are not worth the time of treatment, with the exception of a few cases of recurrent folliculitis on the face.



Illustration 1.

Large carbuncle of the neck in a diabetic. This is now past the stage for further short-wave therapy, and ready for actinotherapy or infra-red rays.



Illustration 2.

Carbuncle at the angle of the mouth. This is the ideal case for short-wave therapy. One cavity is breaking down, but continuation of treatment will hasten resolution of the surrounding abscesses.

Active boils: Active boils are stimulated, and the process of liquefaction is accelerated. With such a large amount of necrotic material the drying action of the heat is unimportant. The pathological process is so hastened that the lesion may be considered sufficiently localized for incision some 24 to 48 hours earlier than without treatment. In areas such as the face and the external ear where other treatment is difficult, this is of great service. Here, of course, continued physiotherapy is a much safer and less disfiguring line of treatment than incision.

Inactive lesions: These may be stimulated, with a revived peripheral erythema, and progress to central liquefaction going to rupture.

Incised boils: Pain may be relieved and healing encouraged, but we believe that this is better effected by fresh air and radiant heat, which is more readily applied to large granulating cavities.

With large carbuncles two difficulties are encountered. Firstly, the carbuncle continues to spread, and there is no satisfactory method of attacking the margin of the lesion which is widely separated from the core; and secondly there is severe pain. Both these difficulties are adequately dealt with by short-wave therapy used as an adjuvant to general treatment. Incision is not to be recommended, and, still less, wide excision. The broken down and discharging carbuncle is best handled with warm hypertonic saline packs, combined with fresh air and sunlight, or, if this is not available, general actinotherapy combined with infra-red rays to the lesion.

Thus, briefly described, are the effects of radiation therapy. Diathermy has been used mainly as a cautery in excising carbuncles, the difficulties of application making it unsuitable for local treatment. Its effects are better carried out by short waves which on the whole are the most useful addition to the anti-staphylococcal armoury. By making the limitations as well as the advantages of the methods clear it is hoped to lead to their more thoughtful use.

PHYSIOTHERAPY IN DISEASES OF THE SKIN

(PART III)

By ROBERT AITKEN, M.D., F.R.C.P.

PRURITUS ANI

PRURITUS ANI is a distressing condition and may make the patient's life almost unbearable. The intense itching interferes with sleep, and the general health suffers. It is useless to X-ray these patients without making a thorough examination as to the possible cause of the itching. Enlarged prostate, hæmorrhoids, and other conditions of the bowel must be investigated. Too frequently X-ray treatment is carried out without any investigation being made, and, while there is an improvement, it is only temporary. I[9] have pointed out elsewhere the effect of alkaline stools in this condition. When X-ray treatment is being given the buttocks must be held widely apart and care taken to protect the parts not to be irradiated. Doses of 75 *r* at weekly intervals may be given. Some workers prefer 150 *r* at fortnightly intervals. If the treatment is not successful in two months' time, it ought to be stopped.

PRURITUS VULVÆ

Pruritus vulvæ is another condition which makes the patient's life miserable. Here again a thorough investigation must be made as to the possible cause before X-ray

9. R. AITKEN (1939), *Brit. J. Dermatol, Syph.*, 51, 13.

treatment is given. It may be necessary to treat from the pubis to the anus, two areas being exposed. The technique is the same as for pruritus ani.

HYPERIDROSIS

Hyperidrosis of the axillæ, hands, feet, and, more rarely, isolated circumscribed areas can be treated successfully with X-rays; in fact, X-ray treatment is the only satisfactory method of dealing with the condition. While a certain amount of atrophy of the sweat glands is necessary to cure the condition, it is not advisable to cause complete atrophy. If treatment is pushed too far, too dry a skin will result with its attendant disadvantages. Small doses, 75 *r* at weekly intervals, may be given, or larger doses at longer intervals, but on no account should erythema be produced. Four to six treatments with the smaller doses will frequently bring about the desired result. It is better to stop the treatment while there is still some sweating, and, if after two or three months there is still too much glandular activity, another course of treatment may be given.

SEBORRHŒIC KERATOSIS

Seborrhœic keratosis derives its importance more from the fact that it may undergo malignant degeneration than from any other reason. Such a lesion responds satisfactorily to a dose of 300 *r* of X-rays. Radium may be employed instead of X-rays, but excellent results can be obtained by using CO_2 snow, the application being made for 45-60 seconds with fairly firm pressure.

LICHEN PLANUS

Lichen planus is not a condition which as a rule requires physical therapy. It responds in a capricious manner to radiation, and X-rays should not be advised as a routine treatment in this disease, as it cannot be said with certainty that the treatment will do more than relieve the itching. If it is decided to X-ray the whole body for a generalised acute lichen planus, the dose ought to be small and the irradiation spread over several days. X-ray treatment, however, is perhaps more usually advised in the circumscribed chronic patches or when the verrucose element is prominent. Even in these cases it is unnecessary to give erythema doses. It is better to give 75 *r* once a week, but the treatment should be discontinued if there is not a marked improvement in six to eight weeks. It ought not to be forgotten that in this disease, or in any other condition for which small doses of X-rays are given, frequently atrophy of the skin and telangiectasis may follow, even though no visible reaction occurred during the course of the treatment. For some years past generalized lichen planus has been treated by administering X-rays to the spinal cord. The cervical and lumbar enlargements are the parts usually irradiated. There does not seem to be any definite opinion as to whether filtered or unfiltered rays give the best results, some workers preferring filtered, while others claim that the best results are obtained by unfiltered irradiation. I have tried this form of X-ray treatment in several cases of lichen planus, but without satisfactory results. Perhaps the technique used by other workers would give better results.

CHEILITIS EXFOLIATIVA

Cheilitis exfoliativa is a condition which is resistant to ordinary treatment. Several workers have used X-rays successfully. As the mucous membrane is more sensitive to X-rays than is the skin, the dose should be kept small. If the attempt is made to clear up the condition in one dose, this should not be more than 225 *r*, but fractional treatment will give equally good results.

GRANULOMA ANNULARE

Granuloma annulare is not a common disease, but it is a condition in which physical therapy gives the best results. Cases have been recorded in which the lesions have disappeared under the administration of mercury or arsenic, but as a rule physical therapy is the method employed. X-ray treatment in doses of 225 *r*, repeated if necessary in a month, will generally clear up the condition. I have, however, known cases more resistant than this to X-ray treatment. Sometimes CO_2 snow is used, the application being made for 45 seconds with moderate pressure.

MYCOSIS FUNGOIDES

Mycosis fungoides is rather a rare skin disease, but it assumes greater importance because it is one of the few skin diseases in which a fatal termination occurs. X-ray treatment is the only hope for the sufferer. One cannot say that the disease can be cured, but relief can be given and life prolonged sometimes for several years. As a rule there is a prefungoid stage, but the condition generally has reached the tumour stage before the patient seeks advice. Sometimes cases occur in which X-ray treatment brings little benefit, new lesions appearing as fast as the old ones involute under treatment. Generally, however, the cases respond. The intense itching is relieved and the fungoid growths regress and disappear. New tumours develop at intervals, but with care and periodic treatment the patients can be kept alive and fairly comfortable for some years. Eventually, however, the lesions fail to respond to the treatment. Other cases respond more thoroughly, remaining without symptoms for considerable periods. The recurrences are amenable to treatment, though in the long run they cease to be so. In irradiating cases of mycosis fungoides, too vigorous treatment ought to be avoided. If too large doses are given, or too great an area irradiated at one time, the toxic absorption from the tumours may cause the patient to be seriously ill with high temperature and prostration. The dose ought not to be more than 75 *r* weekly. If much of the body has to be irradiated, the dose should be less than this to each area, and not more than two areas should be treated on any one day.

A case of mycosis fungoides was recently shown by Sommerville at a meeting of the North British Dermatological Association in Glasgow. This patient was apparently so ill that the piecemeal treatment would not have brought about the result in time to save his life. A different technique was used, the details of which were worked out by Dr. Fulton, Radiologist to the Western Infirmary, Glasgow. The body was divided into two areas, each 80 cm. in diameter, and radiated from a distance of 200 cm. The initial dose to each area was 10 *r* per day, doses being given on five days per week. Further treatment was given, the reaction was a profound one, but, when the patient was presented some months later, the skin was normal and his general condition good. Details of this are to be published in the British Journal of Dermatology, and I am indebted to Dr. Sommerville for permitting me to outline the case here.

HYPERTRICHOSIS

Hypertrichosis is not a serious condition, but it is most distressing to the unfortunate patient. Such sufferers are willing to spend almost any amount of money in the attempt to get rid of the disfigurement. They are acutely self-conscious, and it is essential that the doctor should realise this. The causation is quite unknown. It has been attributed, probably correctly, to ovarian dysfunction, but the administration of the glandular products does not seem to help the condition.

X-rays were used freely both by dermatologists and radiologists in the early part of the century, but it cannot be too strongly asserted that such treatment ought not to

be given. It is impossible to remove the hairs permanently without giving a dose which will damage the skin. The position may be explained to the patient who may say that she is quite willing to risk the atrophy and telangiectasis of the X-ray scar, but this does not justify the treatment being given. The patient does not, and cannot, realise what the X-ray scar looks like, and no amount of persuasion should induce the doctor to use X-rays. The considered opinion of dermatologists, both here and abroad, is against X-ray treatment.

Fortunately other methods of helping these patients are available. In electrolysis and diathermy we have two forms of physical therapy which can give good results. The disadvantage of both methods is the time involved. Each hair has to be treated individually. A good light must be available. In the case of electrolysis the negative electrode is the one to which a fine needle is attached. The patient may insert a few fingers into a small bowl of water in which the positive electrode is placed. The needle is passed down the follicle to the root, and a current of 1-2 ma. allowed to pass for 30 seconds. Frothing appears at the mouth of the follicle. If it does not, the needle has been pushed beyond the confines of the follicle. Adjacent hairs ought not to be treated in succession, and, if the first attempt at removal is not successful, a second attempt on the same day should not be made. A skilful operator can remove about 60-70 hairs in an hour, and the recurrences should not be more than 1 in 10. The failures ought not to be treated till the reaction has passed off.

With diathermy the indifferent electrode may be held by the patient, or placed in a bowl of water into which the patient's hand is inserted. The needle attached to the active electrode is introduced into the follicle, and the current is allowed to pass momentarily. The current is on for such a short time that the patient is hardly conscious of the discomfort. The lack of discomfort is an advantage which the diathermy method has over electrolysis. Two other advantages are that a greater number of hairs can be removed in the same time because of the momentary passage of the current as against the 30 seconds for electrolysis, and that there is little or no visible reaction.

It is sometimes stated that, if an overdose of X-rays has been inadvertently administered, the ill effects can be prevented by exposing the area to ultra-violet rays. It cannot be too strongly asserted that such a belief is erroneous. The subject has been thoroughly investigated by Mackee[10] who found that there was nothing to support such a belief. Indeed, in some of the patients on whom the tests were carried out, it appeared that the ultra-violet rays applied after the X-rays provoked a more intense X-ray reaction. This certainly was my experience when I tested the combined action on myself about ten years ago.

NÆVI

Nævi are lesions, most forms of which are amenable to physiotherapy. The spider nævus, or nævus araneus, is easily dealt with. Either electrolysis or diathermy may be used. With electrolysis the needle attached to the negative pole is inserted into the central vessel, and a current of 1-2 ma. allowed to pass for 30 seconds. The nævus blanches at once and, when the slight redness due to the electricity passes off, the nævus is found to be completely gone. A similar result is obtained by inserting the needle attached to the active electrode of a diathermy apparatus, and allowing the current to pass momentarily. These procedures are a little painful and, in the case of young children, are not altogether suitable. CO_2 snow applied for 15 seconds may be used in such cases, but I do not think that the results are so satisfactory. It is better, in my opinion, to wait till the child is old enough to remain still while one or other of the methods already mentioned is being used, than to use snow in the younger child.

10. MACKEE (1938), *X-Rays and Radium Treatment of the Skin*, 3rd edition.

NÆVUS FLAMMEUS

Nævus flammeus, or port wine stain, is a considerable disfigurement especially in its more extensive forms. Unfortunately treatment of this condition is not very satisfactory. CO_2 snow does not improve the disfigurement to any extent. It leaves most of the capillary element untouched, and adds a scar, and because of this it ought not to be employed. I have obtained the best results from using the Finsen-Lomholt lamp. My early attempts did not give good results, but by increasing the exposure the results have been excellent. I have not, however, treated many cases of this condition with these lamps, as the apparatus was primarily obtained for the treatment of lupus vulgaris. The results have been so encouraging that when possible I shall treat more of these cases with the Finsen-Lomholt lamp. X-rays and radium have been advised in this condition, but ought not to be used, as even when definite atrophy has been produced the nævus still remains.

SUPERFICIAL CAVERNOUS NÆVUS

The superficial cavernous nævus, or raspberry nævus, responds so satisfactorily to CO_2 snow that this is the remedy of choice for ordinary practice. The first application should be short, not more than 15 seconds, and only moderate pressure employed. If a longer application be made, the reaction may be too brisk and a slough result with a disfiguring scar later. Subsequent applications may be longer if the reaction is a mild one, but there is no need to exceed 30 seconds with moderate pressure. The applications are made at intervals of a fortnight to three weeks, depending on the length of time the reaction takes to pass off. Radium may be used instead of CO_2 snow in this condition, the beta rays being employed, and doses short of those required to produce a reaction being given. Usually two or three applications at intervals of a month will bring about the desired result. These lesions should be treated early in life, as they are radiosensitive in infancy, but less so later.

DEEP CAVERNOUS NÆVUS

The deep cavernous nævus may exist alone, or there may be some of the superficial type, associated with it. CO_2 snow treatment is not suitable for the deep type because the reaction is too superficial to influence the vessels. Radium application is the best form of treatment, but, in this variety of nævus, the gamma rays ought to be used. Radon seeds may be inserted into the nævus, but the dose should be small—much smaller than that required for a rodent ulcer. It will be sufficient to have $\frac{1}{4}$ mc. radon for each seed, and one seed for each cubic centimetre of tissue.

PIGMENTED HAIRY NÆVI

Pigmented hairy nævi may be small, or they may cover a large part of the face. If the hairy element is prominent and the patient not too small, it ought to be dealt with, first by electrolysis or diathermy. In the case of a very young child this is hardly necessary. The treatment for pigmented nævi is CO_2 snow, and excellent results are obtained. The applications are made for 15-20 seconds to begin with, and may be increased to 30 seconds if the reaction is not too brisk. The applications are repeated at intervals of two to three weeks and several applications to each area will be required before the desired result is obtained. After four applications have been made to the whole of the affected area it is advisable to stop all treatment for some months. All the reaction produced by the treatment passes off during this period, and a better idea is obtained as to the need for further applications. It is astonishing what a change can be wrought by the treatment. I remember a baby girl of $4\frac{1}{2}$ months who had a pigmented area on the face suggestive of a highwayman's mask of black velvet. Treatment was carried out at intervals until on casual observation, apart from the upper

eyelids, she looked just like a rosy-cheeked girl. These I have had to leave untreated till she is older.

GLANDULAR NÆVI

Glandular nævi may be large enough to be disfiguring, but they can be easily dealt with. Diathermy, under a local anæsthetic, will remove these lesions and, if care is taken not to overdo the application, there is no scar left.

Grenz rays and short-wave therapy are both used in the treatment of diseases of the skin, but I have had no experience of these methods. The former were discussed recently in a paper by Jungmann[11] to which I refer those interested.

Physiotherapy, especially perhaps X-rays, may be used for other conditions, but these perhaps come more within the scope of the specialist. Sufficient has been said, however, to show what an important part physiotherapy plays in the treatment of diseases of the skin.

11. JUNGMANN (1939), *Brit. J. Dermatol. Syph.*, 51, 151.

ELECTRO-MEDICAL APPARATUS: ITS CHARACTER, OPERATION AND CARE:

PART II. No. 11 (continued)

By L. G. H. SARSFIELD, D.Sc., M.I.E.E., A.Inst.P.
Hon. Consulting Radiological Engineer to University College Hospital.

THE X-RAY TUBE

The Rating of an X-ray Tube

WHEN an X-ray tube is in operation, current is flowing through it in the form of a stream of electrons passing from the cathode to the anode. These electrons are released from an incandescent filament at the cathode end of the tube and are shot over to the anode target whenever the target is at positive potential with reference to the cathode, and providing the difference of potential is sufficiently high.

When the cathode is emitting electrons in an enclosed evacuated space, such as we have in an X-ray tube, some of the electrons form a kind of cloud round the cathode setting up what is called a "space charge" which tends to prevent other electrons from getting over to the anode. This is the reason why a high positive potential has to be applied to the anode to maintain current through the tube. The minimal potential difference to ensure that the electrons reach the target depends upon the size, shape and disposition of the electrodes (anode and cathode).

In a thermionic valve (which in its essential components is similar to an X-ray tube) this potential difference need be only of the order of 100 volts, whereas in some X-ray tubes the potential difference required may be of the order of some thousands of volts.

As in the case of the valve* the amount of current through the X-ray tube depends upon filament temperature and on the potential difference between cathode and anode. Also, the X-ray tube becomes saturated for a particular filament condition, so that increasing the potential difference across it does not increase the current, though it does alter the quality of the radiation emanating from the anode.

The product of the current through the tube and the potential difference or voltage

* See *B.J.P.M.*, 1938, vol. 1 (New Series), p 425.

across it gives a measure of the power absorbed by the tube.† A very small proportion of it, less than 1 per cent. appears as X-radiation, the remainder being dissipated at the target as heat. Without proper cooling methods the heat would soon destroy the target, particularly at the restricted area where the bombardment of electrons is received. Consequently the anode, or at least this region of intense bombardment, has to be made of refractory metal which can withstand intense local heating. Tungsten is the material generally used for the purpose and, in the original Coolidge tube diagrammatically illustrated in fig. 164 last month, the whole anode head is of suaged tungsten (fig. 168a). The common practice now, however, is to enclose a block of tungsten in a head of copper (fig. 168b). The tungsten block has an area big enough to receive the whole of the main electron stream, and the heat generated there is conducted to the copper, and thence to the radiator or water stream arranged for cooling. In the water-cooled anode the copper head has a hollow extension to the end of the tube. Within the hollow space a pipe is arranged to deliver water on to the back of the target as shown in fig. 168c. A number of modifications of the simple arrangement shown in fig. 168c have been developed to assist rapid transfer of the heat at the target to the radiating device.

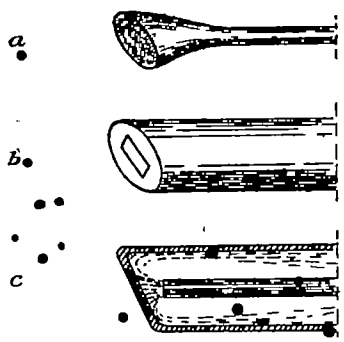


Fig. 168.—Representations of three forms of X-ray tube anode. (a) Solid suagged tungsten anode of original Coolidge universal tube. (b) Solid copper anode with tungsten focal plate. (c) Section through hollow anode showing elementary form of water cooling.

THE ANODE COOLING SYSTEM

It will be appreciated that if, as is generally the case, th[illegible] is at high potential, the cooling water (which is a conductor) is also at high pot[illegible] so that the circulating pump, tank, and connecting tubes must be insulated. The [illegible] motor which drives the pump will be supplied from the mains, and therefore the [illegible] joining the motor to the pump must be of insulating material. The pump unit is frequently arranged as a pedestal with the motor disposed at the base, the pump, tank and radiator being mounted at the top of a hollow insulating pillar enclosing the insulating shaft. This scheme is sometimes inverted, the unit being suspended from the ceiling, and the motor then being uppermost and the pump, tank, and radiator below.

In some types of X-ray tube the anode is designed to work at earth potential and, when this is the case, water cooling can be effected without an insulated circulating system. It is possible in certain of these cases to adopt the very simple plan of connecting the anode cooling system to a water tap.

† This product must be evaluated with due regard to units and to the wave forms of the current and voltage quantities. At this point in our consideration of the subject a simple example will serve as an illustration. With a steady potential difference of 100 kilovolts (100,000 volts) and a continuous current of 10 milliamperes (.01 amp.) the power would be 100,000 volts x .01 amp. = 1,000 watts or 1 kilowatt.

It should be noted here that water is not the only fluid used for cooling the anodes of X-ray tubes. Some manufacturers claim that oil possesses superior qualities for the work. The oil chosen has to be of special quality such that the heat does not impair its free flowing properties nor set up any decomposition liable to produce deposits in the tubes, or more particularly at the back of the target.

One advantage of the oil is that it is an insulator so that, if tubes of rubber or other insulating material be used to convey the oil from the pump and oil reservoir, the tube is automatically insulated from the pumping or radiating system which can therefore be at earth potential.

When the anode of an X-ray tube depends for its cooling upon the flow of a liquid past the focal element, the arrest of this flow during operation of the tube, either by obstruction in the transmission tubes or by failure of the pump or pump-driving motor, would result immediately in dangerous temperature rise of the anode. The consequences of such temperature rise are so serious that provisions have to be made against the risk.

An electrical relay is generally devised such that failure in the water flow opens a switch cutting off the electric supply to the tube. A float may be arranged in the reservoir so that in its correct position it operates a switch *closing* the control circuit. Alternatively, fluid pressure on a flexible diaphragm may be employed similarly to operate a switch mechanism. In either case, failure of the fluid supply, and consequent reduction of fluid level or pressure, causes the *opening* of the control switch and the removal of power from the tube.

THE FOCAL AREA

The size and shape of the area receiving bombardment is governed by the size and shape of the luminous filament. The bombarded area is called the focus. Thus a circular focus is produced by a flat spirally wound filament, while a line focus is produced by a long helical filament. The area of the focus on the target controls the pencil of rays which emerges from the tube. The projection of a line focus from the target upon a plane perpendicular to the beam is a spot, and this represents the effective area of the focus. Now, the finer the effective focus the sharper is the X-ray image, and therefore, for certain work fine focus tubes are in great demand.

It is the effective [illegible] than the actual area of the focus which decides the intensity of radiation in the b[illegible]t it is the actual area which is important from the point of view of heat dissipation.

The power rating of an X-ray tube therefore is a function of the focal area on the target. There may be comparatively small variations of efficiency in different types of anode cooling device, but speaking generally, focal area is a fair gauge of tube output.

THE CATHODE FILAMENT

The filament is a coil of tungsten wire in a metal hood used to control the electric field between cathode and anode. The filament is connected by wire to the screw or pin terminal cap in the cathode end of the tube, and an adaptor wired with suitable flexible leads joins the filament circuit to the source of heating current.

Since the form and temperature of the filament so largely influence the shape and intensity of the electron stream, which in turn controls the focal area on the anode, filaments of different design may be used in tubes for different duties. Thus, for example, a broad focus may be used for fluoroscopic screen work and a fine focus for radiography. In some tubes two filaments are assembled in one hood, and three leads, one common to both filaments, taken from them to a three-terminal cap. A cathode of this type is shown in fig. 169. A switch, either

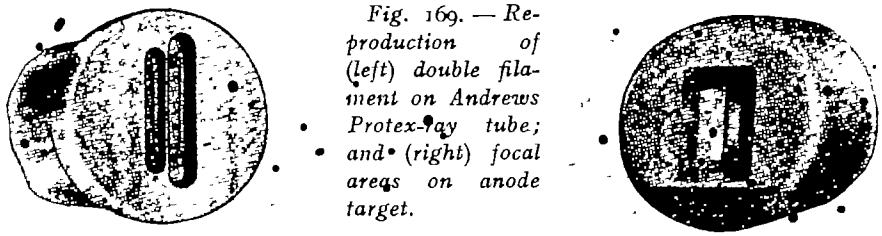


Fig. 169. — Reproduction of (left) double filament on Andrews Protex-ray tube; and (right) focal areas on anode target.

incorporated in the adaptor or at the filament heating transformer, enables either of the two filaments to be used at will.

SOME EXAMPLES OF PRESENT-DAY X-RAY TUBES

A number of types of present-day X-ray tubes will now be considered. As explained in last month's paper, much of the original invention associated with X-ray tubes is the work of American and Continental scientists, and the development of practical features embodied in commercial instruments has largely been in the hands of foreign manufacturers. Many of these will be dealt with in the following pages. But description will first be given of some products of Cuthbert Andrews, a British manufacturer, who for many years has ably served the X-ray industry by the marketing of X-ray tubes and other vacuum apparatus.

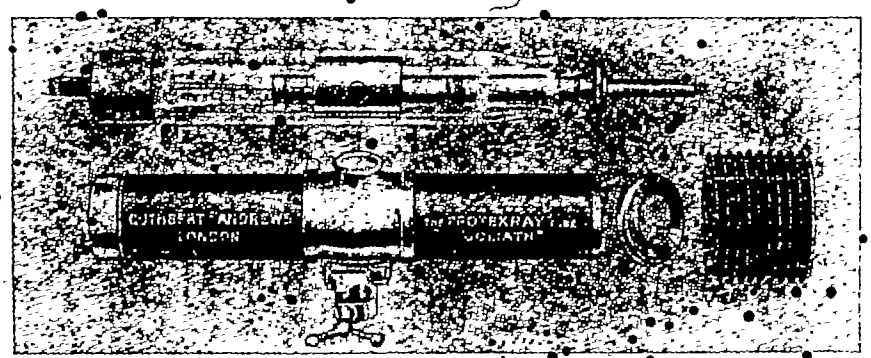


Fig. 170.—The Andrews Protex-ray Tube.

THE PROTEX-RAY TUBE

An example of an Andrews protected tube is shown in fig. 170. It shows (above) the tube itself called the "insert," and below the protective cover and the radiator fittings. The cap at the left-hand end of the insert carries two pin-type terminals by which the heating current is conveyed to the filament. In the illustration the pins are covered by an insulating socket which receives the current-carrying flexibles. At the right-hand end of the tube is a metal stem projecting from the anode rod on which the tube and plate radiator is fitted.

Fig. 171 gives an interesting view with the protective cover and glass of the insert broken inside the central portion of the tube. On the left-hand side the filament, its supports, leads, and hood are clearly seen, and on the right the anode face with the tungsten focal plate is visible.

Surrounding the central area is a metal cylinder (broken to show the details mentioned above), which is maintained at cathode potential and designed to prevent stray electrons from bombarding the glass walls of the tube. As shown in the diagram, this cylinder has a small circular hole (partly dotted in the figure) to permit the rays to pass through.

The ray-proof band round the central part of the tube forms part of the protective cover. The section of this with the ray window at the bottom is clearly shown in the diagram.

Andrews tubes are available in a "shock-free" form, i.e., enclosed in an earthed casing complete with high voltage cables, as described in last month's paper and illustrated in fig. 167. Models of this form are either air or oil insulated inside the metal casing. The oil insulation, of course, permits the tube to have smaller dimensions than when air is used. Moreover, the oil affords a means of cooling the tube, whereas in the air insulated shock-free model a current of air has to be passed continuously through the casing for this purpose. The cooling air is drawn through the tube, i.e., between the metal casing and the glass walls of the tube, by a small fan mounted at one end of the casing. The fan motor is quite independent of the high voltage circuit, and is therefore supplied from the mains by a simple 5 amp. plug connection.

Protex-ray tubes are available in 2, 3, 6 and 10 kW sizes, a combination of two ratings being provided in certain double-focus models. The kW rating of a tube is an arbitrary value, being the product of the mean current and R.M.S. kilo-voltage permissible for one second.

OIL IMMERSED X-RAY TUBES

Much of the early work connected with the oil immersion of X-ray tubes was done by Coolidge and his associates in the General Electric Company's laboratories at Schenectady, New York, when the apparatus incorporating the transformers and tube in a single earthed tank was being evolved.

An early example of this arrangement is seen in fig. 172 which shows the X-ray transformer with two secondary coils, the tube filament heating transformer in front and

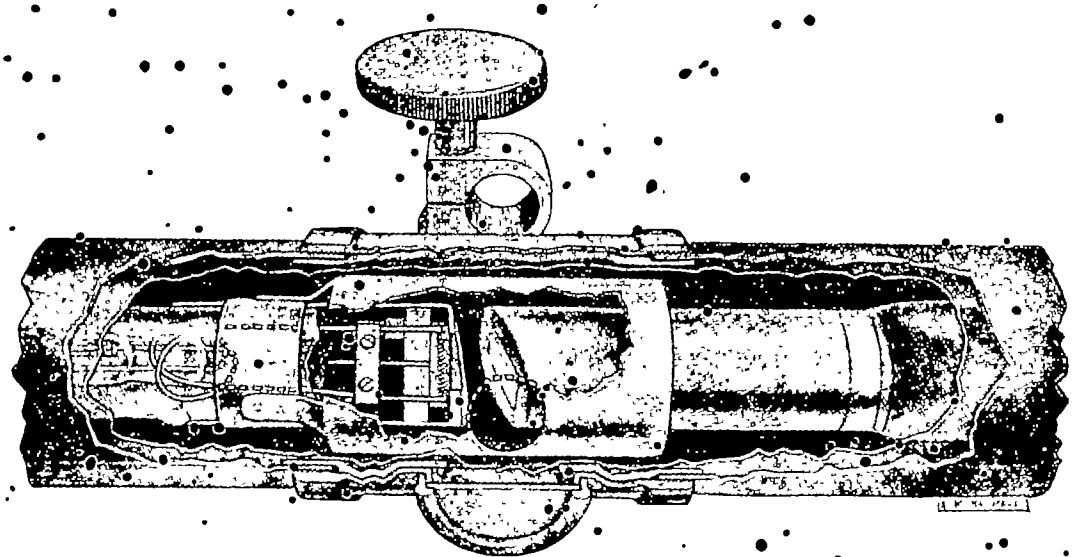


Fig. 171.—Diagrammatic view showing interior construction of the Andrews Protex-ray tube.

the X-ray tube above, all enclosed in an oil-filled tank. This assembly formed a small portable X-ray apparatus used for dental radiography. Diminutive X-ray tubes were developed for this purpose and, while the main X-radiation passed out of the tank through a special window, the stray and unwanted rays were prevented from escaping by the metal walls of the tank and by other suitable baffles.

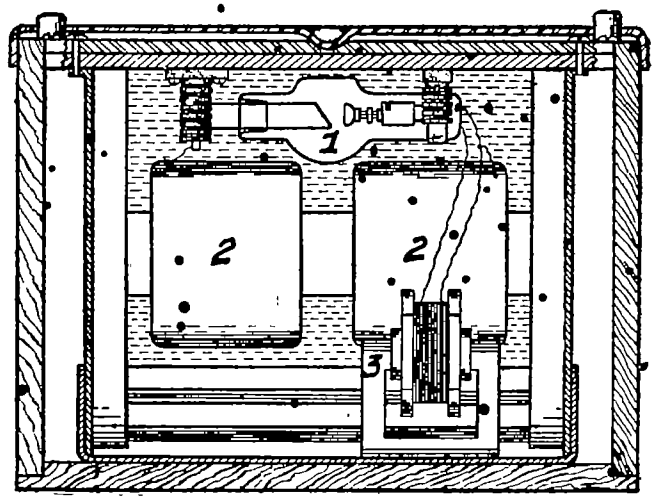


Fig. 172.—Vertical section of portable oil-immersed unit (Coolidge) showing X-ray tube (1), X-ray transformer (2), and separate filament heating transformers (3).

An illustration of a present-day Victor dental outfit is seen in fig. 173. The voltage on the tube in this apparatus is of the order of 55 kv. The principle of oil immersion of tube and transformer has been developed for larger sizes of plant, and it is now adopted for diagnostic machines operating at 90 kv. and deep therapy at 200-400 kv.

A view of a 400 kv. totally enclosed oil-immersed Victor X-ray machine is seen in fig. 174. Further reference will be made to this type of plant when X-ray transformers and the high-voltage circuit are under consideration.

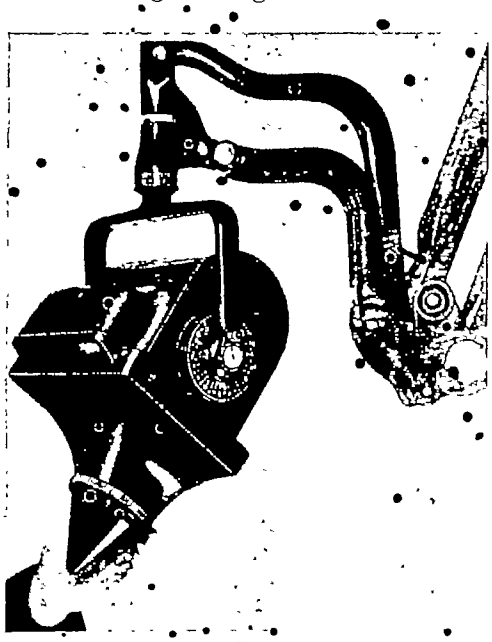


Fig. 173.—Victor X-ray apparatus for dental radiography. The suspended tank unit contains X-ray transformer and X-ray tube, and being externally earthed is perfectly safe to touch.

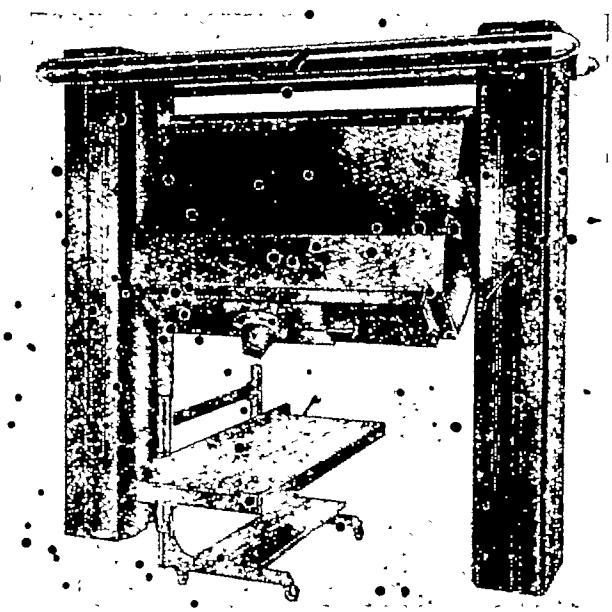


Fig. 174.—A totally enclosed X-ray plant for operation at 400 kilovolts. The size of whole arrangement can be gauged from the couch underneath the tube head.

REVIEWS of BOOKS on Physical Medicine and Allied Subjects

Les Rhumatismes Maladies Sociales

Les Rhumatismes Maladies Sociales. By R. J. Weissenbach and François Françon. 201 pages. Price 55 francs. Paris, 1939: G. Doin & Cie.

The authors give a detailed classification of rheumatic diseases and point out the enormous loss to social and industrial concerns caused by these conditions. Considerable space is devoted to acute polyarthritis, which, in the authors' opinion, should be designated Bouillard's disease. Its ætiology, bacteriology and allergy are comprehensively discussed, and also the morbid anatomy of the condition, with special emphasis laid on the distinctive feature of Aschoff's nodules, which appear in any part where there is vascular tissue. This sign, however, is only considered a phase in a complex evolution. The relation of Bouillard's disease to cardiac conditions and chorea is discussed.

The importance of prophylaxis in regard to the individual and the family is stressed, and various suggestions, including research, scientific propaganda, a campaign of public health, and the provision of special homes and schools for children are outlined. Treatment of Bouillard's disease with salicylate of soda is fully discussed, with due regard to tolerance, methods of administration and contra-indications. The authors advocate the addition of thyroid extract when chronicity is apparent, and recommend the administration of iodine and sulphur in certain cases. They further consider that gold therapy should be used with caution and that bee venom is of no value. The importance of rest, diet and care of the kidneys during acute attacks and avoidance of extreme climatic changes and strenuous physical exertion between attacks is emphasized.

A further section is devoted to the medical and social implications of chronic rheumatic diseases, and includes reports from different countries. Therapeutics are discussed in relation to palliative and active treatment, and stress is again laid on the importance of prevention.

The authors confirm their observations with statistics drawn from their own country, and from Germany, Denmark, the United States, Great Britain and Russia.

A special section of the public health services of France is already devoted to rheumatism, but an appeal is made for the adoption of further preventive measures, and various suggestions, including the compulsory notification of the disease, are put forward. Emphasis is laid on the importance of the recognition of rheumatism as a social evil equivalent to cancer and syphilis.

The aim of this book is clearly expressed on every page—the desire to eradicate, in so far as is humanly possible, a social evil of devastating importance to the communal life. R. D. H.

Radiotherapy in Sinusitis

Radiotherapy in Sinusitis. By W. A. Troup, M.C., M.D., Ch.B. (St. And.). 50 pages, 3 plates. Price 3s. 6d. net. London, 1939: The Actinic Press, Ltd.

In this little book of 50 pages a very adequate description is given of the uses of radiotherapy in the treatment of sinusitis. Dr. Troup is an authority on this subject, and sets out in clear and simple language the results of his own personal experience with this therapy.

A chapter is devoted to an interesting general survey of Physical Measures in the Treatment of Sinusitis, and is followed by chapters on the Physiological Action of Radiotherapy, Technique of Treatment, Adjuvants to Treatment, and Secondary Toxæmic Manifestations. A particularly interesting chapter is devoted to case reports of the author's in which the very striking effects of radiotherapy, and its advantages over surgical treatment, are well illustrated.

This book should be in the hands of every general practitioner whose advice is constantly being sought by sufferers from this widespread and intractable complaint.

THE SOCIETY of PHYSIOTHERAPISTS

The Executive Committee of the Society regrets to announce that, owing to the recent breaking out of hostilities, it has been found necessary to cancel the Annual General Meeting and Dinner fixed for Saturday, October 28th, at the Langham Hotel.

Members of the Society are particularly requested to keep the Hon. Secretary promptly notified of any changes in their address, in order that they may not fail to receive any notices circulated by the Committee regarding activities in which the Society may seek their co-operation. The offices of the Society are remaining for the time being at 159, Victoria Street, London, S.W.1.

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CURRENT TOPICS

THE ORGANIZATION OF HOSPITALS IN WAR TIME

IT was explained in a Memorandum issued by the Ministry of Health about six months ago*, that to work out the details of the emergency organization, Medical Officers of the Ministry, known as hospital officers, had been appointed for different parts of the country and it had been the duty of these officers to prepare schemes which would be suited to those respective areas. These hospital officers now exercise general control under the administration of the scheme, and county and county borough medical officers of health will normally act as their agents.

There has been a general co-ordination of all types of hospitals in each area. It is intended that the majority of hospitals should treat and give first aid to casualties arising from an air raid in an immediate locality. Hospitals outside the more dangerous areas will be organized as base hospitals to which casualties may be drafted.

It was explained in the Memorandum of the Ministry that there was no intention to interfere with the internal management of any hospital other than those which were ear-marked for exclusive use by H.M. Forces and that the responsibility for the maintenance of its services would continue to rest with the hospital authority or governing body concerned.

The Defence Regulations which were made by Order in Council on the 25th August, 1939, give, however, very wide powers to the Minister of Health in relation to hospitals. Under paragraph 32 of these Regulations the Minister and any person authorized by him may give such directions with respect to the management and use of any hospital as the Minister thinks fit for securing that proper hospital treatment will be readily available for persons who may be suffering from any injury, disease or incapacity in consequence of war operations. The power of the Minister also extends to cover hospital accommodation for persons who leave their homes in consequence of, or in apprehension of, attacks by an enemy.

The Minister would no doubt act usually through the hospital officer for the area concerned. If therefore the hospital officer considers it necessary that any particular hospital, which might include any public assistance establishment, should be used exclusively for casualties or evacuees, it would be competent for him to give directions accordingly, and it would be necessary for the local authority concerned to make arrangements for the transfer of any other patients. If any such instructions were given by the hospital officer, this could not absolve the public assistance authority from discharging its statutory duties under the Poor Law Act, 1930, although it would obviously be difficult to discharge these functions properly, particularly if other hospitals and institutions under the control of the Authority are ear-marked similarly for special purposes.

Although it appears to be contemplated that each hospital will be managed normally by the body which is responsible for its management in peace time, very wide powers are given to the Minister by the Regulations. If it appears to him necessary for securing that proper hospital treatment will be readily available for the type of patient in respect of which he is authorized to give directions under the first part of paragraph 32 he may manage the hospital or authorize any person to manage it in accordance with the instructions of the Minister. This power also extends to the provision of hospital accommodation for evacuees as well as for patients requiring treatment on account of war injuries. It is quite clear therefore that, if the Minister considers it to be necessary, he could take over any or all of the hospitals in any particular area whether they were under the control and management of a local authority in the case of municipal hospitals and/or a management committee in the case of voluntary hospitals.

*Emergency Hospital Organization Mem. No. 2.—Defence Regulations, 1939 (S.R. & O. (No. 927)).

THE BRITISH JOURNAL OF PHYSICAL MEDICINE

NOVEMBER 1939 *And International Review* Vol. 2. No. 11. New Series

Original articles are invited on any aspect of Physical Treatment. Such articles are published only on the understanding that they are contributed exclusively to this Journal, which does not hold itself responsible for statements made or opinions expressed by any contributor. The copyright of all articles appearing in the Journal is strictly reserved.

PHYSIOTHERAPY AND THE WAR-DISABLED

THE war of 1914-18 left in its train a whole army of wholly or partially disabled men on the care of whom the Government has spent large sums of money, in the form of hospital treatment, appliances, pensions, etc.

While physical medicine played a useful part in the initial treatment of these men, the subject, viewed as a modern science, was then in its infancy, and its application as compared with other forms of treatment was limited.

Learning from the lessons of the last war, and in view of the great advances in knowledge made in the intervening years, physiotherapy must take its proper place with surgery in the care of those wounded during the present conflict.

Looking at the question from the purely economic viewpoint, the institution of adequate facilities for the proper application of physiotherapy would save the country vast sums of money by rendering many men fit to carry out the work they were trained to do—men who would otherwise become a burden on the financial resources of the country as recipients of disability pensions, etc.

That properly applied physiotherapy can do a great deal to lessen the disability following injuries was clearly shown by Sir Morton Smart in a recent issue of this *Journal* ("Physical Medicine and Industry," July, 1939, pp. 178-187). In this paper he quoted the following words of Dr. Locke, chief surgeon to a large American insurance company with his own hospital. "There is no question from our experience that the period of disability in a large majority of cases has been lessened. We believe that the advantages of physiotherapy are not only in lessening the period of disability but also in aiding us to have the patient under close observation, and in encouraging him to return to his own, or some other occupation." What physiotherapy can do in the way of ameliorating the effects of industrial injuries, it can certainly effect in relation to war injuries.

Not only can physiotherapy be employed with great benefit in the treatment of wounds, nerve and muscle injuries, and fractures, but it can give valuable assistance in the early treatment of the rheumatic affections to which damaged joints are particularly liable, thus preventing the occurrence of a chronic and crippling condition.

It seems obvious that the establishment of a properly equipped and staffed physiotherapy department in every civil and military hospital, working in close collaboration with the surgical units, is an urgent necessity. With regard to the cost of such a scheme, this would not be great when compared with the inestimable suffering and immense economic loss which it would undoubtedly obviate.

THE PRESENT STATE OF SHORT-WAVE DOSIMETRY

By HANS WEISZ (DR. MED. ET DR. PHIL.).

SHORT-WAVE therapy holds a unique position among the various methods of thermotherapy. Treatment with air-spaced electrodes, which is made possible only by using short waves, simplifies the technique and improves the effect on deeper tissues under certain circumstances. Hitherto, these advantages were partly offset by the fact that we had no means of measuring accurately the energy absorbed by the patient. One was compelled to rely entirely on the patient's statements (feeling of slight warmth, of agreeable warmth, of heat). On the other hand the results of experimental research work were invalidated, as only the wave-length, but not the absorbed energy, could be measured. That may be the reason why various workers studying the same problem so very often obtained entirely contradictory results.

Thus introducing a practical method of dosimetry seems to be justified for theoretical and practical reasons. The method having been developed by Eugen Mittelmann in the last two years, the task of applying it in clinical practice could be undertaken. All the authorities who have used this method agree about its accuracy. Its simplicity is such that any assistant is able to employ it after a very short time.

Without complicated mathematical formulæ the principle of the method may be explained as follows: If an object is put between the two plates of the condenser of a short-wave generator, one part of the energy is absorbed and converted into heat in the object, while another part is radiated into space. The measurement of the absorbed portion is the only thing that matters. It is a function *of the voltage across the condenser plates,* and of the so called *"equivalent" resistance of the object.* (If a direct current flows through an object, the absorbed energy depends on the drop of potential across it, and on the resistance of the object). The latter can be defined as the resistance of a hypothetical object which, on being in direct contact with the condenser plates, would absorb the same amount of energy as is absorbed by the object under actual working conditions—the voltage on the condenser plates being unchanged. The power absorbed by a certain object depends to a great extent on its position in the field. Thus the equivalent resistance is related not only to the shape and nature of the object, but also to its position in the field.

How can this quantity be measured? Let us suppose that there is a certain voltage across the condenser. Since an object is put in the field the original voltage decreases as a function of the absorption of energy in the object. The magnitude of the drop is a measure of the power absorbed in the resistance, and therefore characterises the equivalent resistance.

Details may be seen in a schematic diagram of the apparatus (Fig. 1). G is the short-wave generator; C_1 the condenser for tuning the oscillatory circuit; C the condenser between the plates of which the treatment is done; cc are coupling condensers connecting the oscillatory circuit with a thermocouple T; M is a galvanometer and R a calibrated resistance. If E is the tension across the plates of C, the thermocouple is passed by a current proportional to E. The rise of temperature and the current originating in it are proportional to E^2.

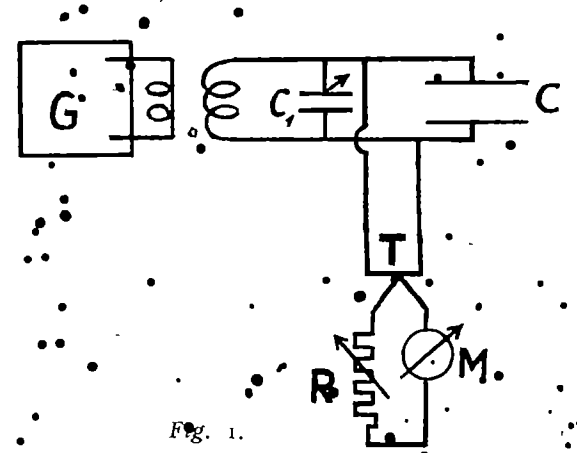


Fig. 1.

As this current passes through the galvanometer M, its deflection is proportional to E^2, but it depends on the adjustment of the calibrated resistance as well.

The formula for the absorbed energy in the object is given by $\frac{E^2}{R}$, E being the tension across the condenser plates and R the equivalent resistance. In any special case the calibrated resistance may be given such a value that the deflection of the galvanometer becomes proportional to $\frac{E^2}{R}$, i.e., to the energy absorbed in the object in the condenser field.

The technique of application is as follows: First the voltage of the empty condenser (the oscillatory circuit being in resonance) is adjusted to a definite value which can be seen on the galvanometer. Then the patient is put in the field, the drop of voltage is observed, and the calibrated resistance is then adjusted corresponding to that drop. [This correspondence had been found out empirically by experiments with phantom loads]. As the treatment proceeds, the apparatus automatically registers the energy absorbed ($\frac{E^2}{R}$) in watts. Needless to say various amounts of energy might be administered arbitrarily.

The following results are based on investigations begun together with Kowarschik in 1937, and carried on until the first half of 1938. Meanwhile they have been confirmed and partly completed by Kobak. Special attention must be drawn to some interesting facts found out by Kowarschik in Vienna during the last months which will be referred to later in greater detail.

In the first series of experiments we aimed at finding the degree of accuracy obtainable. The control measurement of the energy absorbed by the patient is hardly possible. So we worked on phantom loads (NaCl solutions of various concentrations, olive oil, mixtures of salt solution and oil in different containers) using electrodes of varying sizes at various distances. The limits of error, which at first lay between $\pm$ 15%, with further improvement of the apparatus were later reduced to $\pm$ 5%. This accuracy is quite sufficient for the requirements of everyday practice, and for most of the theoretical investigations.

It would exceed by far the scope of this short paper to relate in detail all the experiments which were carried out to calibrate the instrument. They are of no importance from the clinical aspect of the problem.

Dosimetry for clinical purposes was developed first by attempting to co-ordinate the absorbed power to the heat sensations of the patients. We defined four degrees of heat sensation: degree I, beginning feeling of warmth (threshold value); degree II, mild warmth; degree III, definite feeling of warmth, but not unbearable; and degree IV, hot, not tolerable in longer exposures.

Experiments were made on typical treatments (wrist, elbow-joint, shoulder, ankle, knee, hip, head, arm, leg, chest, abdomen) of a great number of living subjects. Varying amounts of watts were administered, and the degree of heat sensation appearing after some minutes was registered. It was observed that the statements of various subjects did not vary as much as we had expected, provided that the conditions of the experiment as regard size of electrodes and air spacing were kept constant. In the first series of experiments circular electrodes of 100 c.c. at a distance of 4 cm. at either side were used. By means of a small rod inserted through a hole in the centre of the plate the distance was measured and kept with sufficient accuracy. The results led to the following conclusions.:

The amount of energy dissipated in tissue in order to produce a certain degree of heat sensation bears a direct relation to the volume of the part treated. For example, a very slight warmth is felt in the ankle or in the elbow at a dosage of 10 and 15 watts respectively, whereas in the treatment of the chest more than 40 watts are necessary to obtain similar effects.

For the same parts of the body the amounts of watts corresponding to the four degrees of heat sensation are approximately in the ratio 1 : 1, 5 : 1, 8 : 2, 2. It should be noted that the amount of energy giving rise to a distinct but bearable feeling of heat is a little less than double the threshold value, while that giving rise to an unbearable feeling of heat is a little over this value. This ratio holds good for any part of the body.

Thus the feeling of heat and the absorbed wattage bear a definite relation to one another. These, however, do not hold as regard the relation between the rise of temperature of the skin and the power absorbed. This may be illustrated by an example. In a series of experiments of Kowarschik, in which the knee joints of various subjects were treated under similar conditions according to degree III, the rise of skin temperature lay between 1.2 and 3.0° C.

From experiments like these it may be concluded that the patient's sensations and their statements are a better guide to the amount of energy absorbed than the measurement of skin temperature.

Treating the same part of the body with electrodes of different sizes, at the same distance, more watts had to be applied for larger electrodes in order to reach the same feeling of heat. This result is in no way surprising, as a greater volume of tissue is treated. For example, in treating a knee joint the amount of watts had to be trebled when electrodes of 200 c.c. were substituted for electrodes of 50 c.c.

In further experiments the same part of the body was treated with the same electrodes, but with varying air gaps. It was seen that, to obtain the same feeling of heat, a smaller amount of watts was required as the distance increased. This result was quite unexpected since, with greater spacing of electrodes, deeper tissues are warmed relatively more in comparison with the skin. As almost all experiments gave the same results, the fact itself can hardly be doubted, although the reason cannot yet be fully understood. The assumption that error might account for these surprising results does not hold, as on theoretical grounds an error in the opposite direction would be more rational.

To illustrate the importance of the quantitative aspect of the problem some results of Kowarschik's paper may be quoted. Treating a knee joint with 2 electrodes of 50 c.c. size at a distance of 3 cm. on either side, 27 watts were needed to obtain a very slight feeling of warmth, whereas 57 watts produced an almost unbearable sensation of heat. With a spacing of 7 cm. the same results were obtained with 10 and 21 watts respectively. These discrepancies are unlikely to be caused by simple errors of measurement, as errors of this magnitude were not observed in analogous experiments on phantom loads.

Repeated treatments of different parts of the body under various conditions of dimension and spacing of electrodes yielded useful data. But difficulties arose when it was attempted to find a general principle and to give simple rules of dosage in any special case. This principle was discovered by Kowarschik and published some months ago. *The number of watts necessary to obtain a certain degree of sensation of heat* depends in a very complicated way on the part of the body, and on the size of the electrodes and their distance. But an extremely simple relation is found to the *equivalent resistance* which Kowarschik—somewhat at variance with the general terminology—called "damping." In other words, the dosage depends essentially on the drop of tension when the patient is put in the condenser field. In the apparatus used by Kowarschik and myself the amount of damping always varied from 0 to 90 units of the arbitrary scale of the apparatus. It was found that, for each unit of damping, 0.4 watts were necessary to obtain a very slight feeling of warmth (Degree I), while 0.6 and 0.7 watts were required for Degrees II and III respectively.

An example will best illustrate this. Let us suppose that in the treatment of the knee joint a damping factor of 50 was found. To obtain a slight feeling of warmth

0, 4 × 50 = 20 watts are needed. To produce a distinct, but not unbearable, heat 0, 7 × 50 = 35 have to be applied.

We have said that the unit of damping was chosen arbitrarily. Should this unit be universally adopted, every apparatus would have to be calibrated in a definite way, using certain test solutions of NaCl under specified conditions of shape and size of the container as well as of electrodes, air-gaps, etc.

It is well to realise that in practice slight involuntary changes of the patient's position in the condenser field lead to marked alterations of the power absorption. The conditions for resonance are disturbed and the wattmeter registers erroneous values. It is therefore essential that the patient should maintain his position as far as possible during the treatment. This is expediently achieved by using a special chair with a head-rest. A chair which fulfills these requirements has been devised by Dr. Bauwens.

What is the optimum of heat sensation that should be aimed at? The scope of indications for short-wave treatment embraces inflammatory conditions of various kinds (acute and chronic), spasms of smooth muscles, neuralgia, neuritis and some degenerative diseases. It is, I believe, advisable to treat acute inflammations with a small dosage (Degree I). Spasms of the smooth muscles, and of vessels, are best treated initially according to Degree I, but this may be increased, if no untoward reactions occur. The slightest pain arising during the treatment calls for a decrease in the dosage. Angina pectoris should be watched most carefully to avoid bad accidents. Chronic inflammations and degenerative diseases may be treated with larger doses (Degrees II or III).

It is hoped that further control investigations will confirm the results laid down in this paper. Some essential problems of short-wave dosimetry seem to be solved. The next task will be to measure the rise of temperature inside the body in connection with various amounts of energy absorbed under various external conditions, and to extend all these investigations to a symmetrical arrangement.

BIBLIOGRAPHY.

EUGEN MITTELMANN, Dosimetry in short-wave therapy. *Archives of Physical Therapy*, October, 1937.

EUGEN MITTELMANN and DISRAELI KOBAK, Dosage measurement in short-wave diathermy. *Archives of Physical Therapy*, December, 1938.

JOSEF KOWARSCHIK, Die Dosismessung in der Kurzwellentherapie. *Munch. med. Woch.*, 1939. Nr 4.

ULTRA-VIOLET IRRADIATION IN SKIN DISEASES

By AUSTIN FURNISS, L.R.C.P., L.R.C.S., L.D.S., D.P.H.

THERE is no doubt that ultra-violet irradiation, when efficiently employed, is of great value in many skin diseases; but at the outset one must say that it is not a panacea in dermatological practice. The valuable action of ultra-violet irradiation in skin diseases is due to many effects. Amongst the general effects are:

(a) Stimulation of cellular metabolism; (b) increased resistance of the body to infection; (c) stimulation of the vasomotor reflexes of the body (there is an increased tolerance to extremes of temperature); (d) improvement in the functional activity of the skin in consequence of a redistribution of blood amongst the organs of the body; (e) production in the skin of vitamin D which hastens the healing of certain skin conditions; (f) alteration in blood chemistry (calcium, potassium, etc.), the rays acting as a mordant for calcium; and (g) a marked psychological improvement.

Amongst the local effects are:

(a) A bactericidal action on the surface of the irradiated skin; (b) hyperæmia, with dilatation of the capillaries of the dermis; cellular nutrition is improved; (c) a sedative and antipruritic action; (d) inflammatory and caustic effects which certain conditions require can be produced; (e) a keratinous action; the basal layer of the epidermis absorbs the ultra-violet rays, and, according to the photo-chemical absorption law, reactions only occur in tissues which absorb radiation. The basal layer forms all cells external to it and by activating this the rays cause new epithelial cells to be formed.

DOSAGE

The dosage in skin conditions depends on three factors, namely the patient's make-up, the pathological condition present, and the physiological action desired. Patients presenting allergy suffer toxic reactions more rapidly. As in all dermatological manifestations, the physiological result desired is an absorption and resolution of the pathological condition present, together with an alleviation of all subjective symptoms. Consequently the stage, type, and extent of the condition govern the treatment applied, and this in turn controls the physiological effects obtained. As a general rule, acute conditions require sedative doses; frequently repeated small doses should be given. The sedative effect of ultra-violet irradiation on the nerve endings in the skin is very valuable in allaying the intense and distressing itching associated with many skin dermatoses. Chronic conditions require large doses at longer intervals, the doses often being sufficiently large to cause blistering. Where there is marked induration the occasional application of X-rays in addition to the ultra-violet rays often hastens recovery. As in other forms of disease, it is advantageous to combine ultra-violet irradiation with external and internal remedies. It is not the object of this paper to describe all the diseases of the skin which can be beneficially treated by ultra-violet irradiation, but briefly to mention the more common conditions which can be effectively treated by this radiation. Accordingly the following list of skin lesions will be dealt with :

Inflammatory Conditions of the Surface Epithelium

Impetigo contagiosa; pityriasis; psoriasis and parapsoriasis; xerodermia and ichthyosis; and rosacea.

Inflammatory Conditions of the Deep Epithelium

Acne vulgaris; sycosis (coccogenic); alopecia (areata and totalis); lichen planus; onychia; and tinea circinata and tonsurans).

Inflammatory Lesions of the Skin

X-ray dermatitis; burns and scalds; eczema; seborrhœa; herpes; pernio; urticaria; and dermatitis venenata eruptions caused by the direct contact of irritant substances with the skin.

Infective Inflammatory Conditions of the Corium

Furunculosis; erysipelas; and lupus erythematosus.

Skin Diseases Accompanied by Irregularities of Sensation

Pruritus (general and local).

New Growths

Cicatricial contractures and scars; keloid; pigmented nævi; port-wine stains; ulcers (various); and indolent wounds.

Tuberculous Skin Lesions

Lupus vulgaris; scrofulodermia and scrofulous ulcers; and erythema induratum.

INFLAMMATORY CONDITIONS OF THE SURFACE EPITHELIUM

Impetigo Contagiosa

This condition is caused by the streptococcus pyogenes. Local treatment should be given with either the Kromayer water-cooled lamp or the air-cooled mercury-vapour lamp. All crusts and discharges should be removed by starch poultices or olive oil. A third degree erythema is necessary as a strong reaction is required, and treatment is repeated until risk of relapse is past. This produces a bactericidal effect and brings an increased flow of blood and lymph to the part. Treatment is usually given every second or third day. Antiseptic ointments can with advantage be used in addition. Irradiation will definitely check the infection, and it is found that three or four applications of the rays in the course of a week or ten days will usually cure an impetigo contagiosa at any stage. A course of general body baths with the mercury-vapour lamp is helpful.

Pityriasis

This condition does well under ultra-violet irradiation. Only mild doses, given two or three times a week, are required. The itching is relieved and the duration of the disease shortened. Four or five exposures effect complete restoration of the skin to normal. A tonic course of general ultra-violet irradiation is beneficial.

Psoriasis

This disease, which has resisted so obstinately nearly all other measures, often yields to suitable applications of light. An interesting feature of the disease is the fact that, under a tropical sun, many patients are speedily cured, but relapse as soon as they return to more temperate climates. The hands and face are, as a rule, little affected owing to the protective action of light. A good proportion of cases rapidly regain normal skin.

As with eczema, the varied forms of the disease necessitate different procedures of treatment; and similarly, it is essential to avoid any severe erythema reaction in the acute eruption stages. General body treatment is given; a sub-erythema reaction only if the acute eruption is spreading. In other cases a first or second degree erythema is given, the distance being shortened and the time increased at each exposure with the object of giving an erythema reaction each time. At least three treatments at two weeks' intervals are given after clearing up of the skin condition. In resistant cases with hyperkeratotic plaques it is necessary first to soften the plaques with baths and coal-tar ointment, so that they can be readily removed. The Kromayer lamp is then applied locally to the plaques, giving a fourth degree reaction (covering the healthy skin). The blue filter with a four-fold exposure will give deeper penetration for resorption of heavy crusts. Repeat as required. The treatment is combined with general body baths, to give a first degree erythema.

One method of treatment aims at combining the effects of pure infra-red irradiation and short exposures to a mercury-vapour lamp. Scaling quickly ceases and only the red pigmented areas of skin remain. This method is stated to be more hopeful than any of the methods tried hitherto. Cignolin ointment, combined with other therapeutic measures such as ultra-violet irradiation, has given good results. Cignolin (Bayer) is chrysarobin minus the methyl group and is applied in ointment form, the percentages recommended varying from $\frac{1}{4}$ to 5, according to the method of application.

Parapsoriasis

This condition responds well to actinotherapy. Very vigorous and protracted treatment is required. The best results appear to be obtained by the combined use of ultra-violet irradiation and the internal administration of arsenic, in the form of sodium cacodylate.

Xerodermia

In this condition, which is characterized by an excessive dryness of the skin, dry thyroid extract is very useful, and, as ultra-violet irradiation stimulates thyroid activity and improves the nutrition of the skin, it often proves very useful.

Ichthyosis

A stimulation of the keratic function of the skin is required and, therefore, a strong inflammatory reaction is necessary.

Rosacea

Ultra-violet irradiation gives good results in this condition. In mild forms an air-cooled lamp is used, a second degree erythema being produced. In severe forms, compression treatment with the " Kromayer " lamp fitted with a blue " Uviol " filter is necessary, a fourth degree (blister dose) being given. This causes thrombosis and, consequently, obliteration of the small vessels. There are no dangers associated with this form of treatment.

INFLAMMATORY CONDITIONS OF THE DEEP EPITHELIUM

Acne Vulgaris

This is a chronic skin disease affecting the sebaceous follicles, and is very common on the trunk and face. The infection is due mainly to staphylococci, and in many cases proves very resistant to treatment. A great many cases do well under ultra-violet irradiation, but it cannot be said to be a cure. Relapses sometimes occur, and certain forms require concomitant measures. Every patient should be told something of the nature of the disease, so that he or she may carry out the very careful " toilet of the skin " necessary if any degree of success is to be achieved with ultra-violet light.

M. L. Macerón describes two different kinds of dosage: (a) The strong single erythema dose which leads to peeling of the superficial layers of the skin, and often to cure; and (b) repeated weak doses which are suitable for the foci. Hugo Bach considers that the single heavy dose which aims at removing the diseased skin is suitable for mild cases, but that in the obstinate case X-rays are necessary. H. Semon has obtained good results by using small doses of X-rays. The lamp of choice in the treatment of this disease is the mercury-vapour lamp. The patient must be treated for any underlying disorders, particularly constipation or anæmia, and take an alkaline diet. He should be warned that a sunburn reaction will be produced.

In pustular acne it is well to evacuate pustules before irradiation, and cleanse with alcohol. Some authorities (Thedering; Sibley; Donnelly) recommend X-rays, in combination with actinotherapy, for resistant nodules.

Specific treatment with vaccines has been widely employed, and carefully controlled dosage as a rule produces satisfactory response. Vaccines are undoubtedly indicated in severe cases, but give much better results if used in conjunction with ultra-violet light.

Sycosis

This disease, though more obstinate than impetigo, rapidly clears up under the influence of ultra-violet irradiation. Cases of long standing require vigorous treatment and perseverance. Treatment should continue for a considerable time after the last lesion disappears; in order to obviate relapse. If special instructions be given the patient as to the disinfection of his shaving brush, razor, and all toilet articles he brings into contact with his face, the condition will not relapse.

Technique. The Kromayer or mercury-vapour lamp is used locally on the lesion and on a small margin of normal skin. The hair should be cut very short before

irradiation. A vigorous third degree erythema should be produced and repeated on subsidence, increasing the dose so as to evoke the reaction at each treatment. Treatment should be continued after the condition has apparently cleared up.

Alopecia

Two types of this condition are commonly encountered, namely alopecia areata, or patchy baldness, and the more extensive alopecia which affects all the hairy parts of the body. In the treatment of alopecia it is advisable, in view of a possible constitutional cause, to give general treatments, say two a week, in addition to local treatment. The local treatment varies in the hands of different actinotherapeutists. The aim in treatment is to stimulate the follicles to regrowth. Prognosis is best in recent cases, but age and long-standing disease are not contra-indications.

The scalp must be scrupulously cleansed before treatment. The following method if often adopted. After thorough cleansing of the scalp, first with soap and water then with plain water, so that all grease is removed, the lamp is applied in such a manner as to produce a second to third degree erythema. Each patch of baldness should be treated individually. When there are several patches all may be treated at once, or, if more convenient, the different areas may be treated in succession. The lamp generally used is the mercury-vapour or tungsten arc, and the dose is four to six minutes at a distance of twenty-four inches. One local and two general treatments a week are usually sufficient. Nagelschmidt uses a mercury-vapour lamp, at 12 inches distance, and with 10 minutes' exposure. It is important to ensure that the rays fall at right angles on the area; two to three exposures may be required. Pain or œdema is allayed by suitable compresses. This reaction is repeated every 2 to 3 weeks, increasing first exposures. After re-growth of hair is thoroughly established, two or three more treatments should be given. If it becomes evident that the follicles are dead, treatment should be discontinued.

Lichen Planus

The term lichen is often loosely used to designate a number of diseases which have nothing in common but the fact that at some time or another the eruption has been papular in character. Lichen planus is ordinarily characterized by an eruption of small irregularly-shaped papules, flat on the top and sometimes umbilicated. The eruptions clear up rapidly under actinotherapy. When the papules are prominent, third degree erythema should be produced. In every case vigorous erythema is necessary, and in some cases X-ray applications are required. The acute form of the disease usually disappears quickly under mild irradiations with the mercury-vapour lamp, such as will produce a first or second degree erythema. The treatment may be applied every other day.

Lichen hypertrophicus necessitates prolonged compression with the Kromayer lamp. In a case reported by Bernstein, repetition during four months effected eradication of the trouble.

Onychia

An erythema dose of the third degree is required. The application should be repeated after five to seven days, or as soon as the reaction has subsided.

Tinea (Circinata and Tonsurans)

Ringworm of the body can be cured with an exfoliative dose produced by the Kromayer lamp, using compression. If the patches are large, the air-cooled mercury-vapour lamp may be used. The desquamation produced removes the parasites mechanically. Strenuous reactions are essential.

Ringworm of the scalp is best treated by X-rays, although occasionally permanent X-ray baldness occurs. Ultra-violet irradiation is painless and free from the danger

or discomfort associated with X-ray epilation or thallium acetate treatment. Some authorities use ultra-violet irradiation for localized scalp ringworm. The head is close-cropped and the area immediately around the infected patches shaved. Intensive doses are then given, i.e., four minutes at eighteen inches from either a mercury-vapour or tungsten-arc lamp, a paper shield with a hole cut in it a little larger than the area to be treated being used. If a second dose is necessary, six or eight minutes application is generally sufficient. Other authorities treat the patches with the Kromayer lamp, using compression; several intense irradiations will often effect a cure. Ringworm of the scalp, however, is often widespread, making the use of X-rays an absolute necessity. The diagnosis of ringworm by filtered light will not be dealt with here.

INFLAMMATORY LESIONS OF THE SKIN

X-ray Dermatitis

Ultra-violet irradiation has been used for the treatment of these burns. The treatment of acute X-ray burns is easy and results are quickly secured. Often the great pain will ease up after the first treatment, and entirely disappear in five or six days. The Sollux lamp is applied to the ulcer surface at the closest possible distance, for 30 minutes at least. This is followed by the Kromayer lamp, a massive dose (3 to 4 times fourth degree) on the entire ulcer surface, using applicators to any cavities. This is followed by the mercury-vapour lamp, evoking a third degree erythema on the skin surrounding the ulcer (but covering the ulcer with black silk). Treatment is repeated at intervals of 2 to 3 days. As new granulations appear, the dosage on the ulcer surface is progressively reduced so that these are not destroyed, but the erythema doses on the surrounding skin are progressively increased. These treatments are continued after the ulcer is apparently healed, adding diathermy to remove deeper fibrosis. Most cases of X-ray and radium damage offer prospect of success if the treatment is persevered with, although it is long and tedious. When the skin is unbroken very careful irradiation should be given. Irradiation is valuable for producing regenerative changes and removing keratoses. The tungsten arc, with a focalising quartz mirror behind the arc, is often used, the average exposure being five minutes at a distance of three feet, two or three times a week. Some authorities use the Kromayer lamp, with the blue filter and compression, for ulcers; whilst for simple and mild dermatitis two or three treatments a week with the air-cooled lamp are sufficient.

Erythema due to X-rays can be detected by fluorescence when invisible to the naked eye; affected areas stand out in an intense brown colour against the normal skin. This opens the way to early use of remedial measures.

Burns and Scalds

It is an interesting fact that burns, even sunburn, are benefited by applications of ultra-violet light. Actinotherapy relieves pain more rapidly than any other method; healing is more rapid, and the resulting scar is finer. The technique is necessarily varied according to the extent of the lesion, and the patient's condition. The first exposures should be fairly strong in order to cleanse the wound, and, later, mild doses should be given to regenerate the destroyed epithelium. The rays have a bactericidal action and stimulate new cell formation. Both general and local applications should be made. The general should be such as to produce a faint erythema. Irradiation for the general treatment is given twice a week, and the usual commencing dosage is two or three minutes, at thirty-six inches. In the local treatment a blue filter is sometimes used, so as to absorb the short abiotic rays, which may destroy the new epithelium.

Localized lesions. The lesion should be cleaned with liquid paraffin, and any adherent fragments of dead tissue removed. The burn should then be covered with

a thin even layer of liquid paraffin. This can be done by soaking a double layer of gauze in the oil, squeezing out excess, and laying it carefully over the burn and a margin of undamaged skin. When ready to irradiate with the Kromayer lamp, the gauze should be peeled off by two adjacent corners, making sure that the surface is fully and evenly covered with oil. Irradiation with the Kromayer lamp is given at a distance sufficiently great to cover the lesions and margins. A mild dose, e.g., 30 seconds at six inches, is given. The lesion is dressed with a plain gauze pad soaked in paraffin. The irradiation is repeated daily, giving the same dosage. When epithelialization is well established, say, in seven to ten days, a slight increase may be needed if the rate of healing slows down. Using the mercury-vapour lamp general body baths should be given, employing sub-erythema doses for their sedative effects.

In larger lesions the mercury-vapour lamp should be employed as above described. After covering with a film of paraffin, irradiations should be given, employing a first degree erythema dose (e.g. 2 minutes at 30 inches). This should be repeated daily. If the burn is heavily infected when first seen, 50 per cent. more than a first degree erythema dose, for the first treatment only, should be given to promote cleansing; thereafter treatment should be continued with milder doses. It is important to remember that newly-formed epithelium is easily damaged by short bactericidal rays. The liquid paraffin acts as a filter, and, if it is not used, only the mildest dosage should be given during the regenerative stage of the lesion, or the blue filter used for long-wave technique.

Eczema

This disease may be produced by a variety of causes, and an endeavour should be made to remove the exciting cause and to correct any accompanying metabolic disorder. Actinotherapy is a valuable adjuvant for promoting healing of all forms of eczema. Being usually due to underlying metabolic disorders, the condition calls for general irradiation applied for its systemic effects. The diverse skin manifestations necessitate a very varied technique of irradiation which must be suited to each case, and combined with other therapeutic measures.

Ultra-violet irradiation is of especial value in the less acute and more chronic forms. In the very acute or wet type some authorities withhold treatment. In the mild forms, sedative doses are beneficial.

Before treatment is commenced all traces of discharge, crusts, or ointment, should be removed. Whatever its course, an acute eczema soon becomes complicated by secondary sepsis (staphylococcal and streptococcal), and therefore the lamp to be selected is the mercury-vapour. The dose should be two minutes over the whole areas affected, two or three times weekly, and gradually increased to ten minutes. General irradiation in addition to local treatment is advisable, as before mentioned. Most chronic eczemas appear to be associated with faulty metabolism, and are more resistant to treatment and need more drastic measures. Third degree erythema should be produced and, if the progress is very slow, X-rays should be used in conjunction with the ultra-violet irradiation. In resistant cases Saidman obtains good results by the combined use of ultra-violet rays, X-rays and the high-frequency spark discharge.

In the case of chronic eczema associated with much hyperkeratosis, Lomholt advises the use of the Finsen lamp. He reports 60 per cent. of his cases of chronic eczema as cured, and 25 per cent. improved. He recommends that erythema be produced in every case, the average exposure being 15 minutes. H. D. Halcin-Davis considers that there is no condition in which X-rays can show more brilliant results than in the treatment of chronic eczema. Huldschinsky has obtained excellent results by wetting the eczematous surfaces with 5 per cent. silver nitrate solution and irradiating locally until the solution blackens. This treatment is repeated every 1 to 2 days until healing occurs.

(To be continued)

ELECTRO-MEDICAL APPARATUS: ITS CHARACTER, OPERATION AND CARE:

PART II. No. 1. (continued)

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Hon. Consulting Radiological Engineer to University College Hospital.

THE X-RAY TUBE

VARIOUS TYPES OF X-RAY TUBES

AN example of a shock-proof X-ray tube for high-voltage working is shown in Fig. 175. This tube, a Philips product, comprises a glass " insert " (i.e., the X-ray tube proper) enclosed in an earthed case fitted with earthed sheathed cables at the ends. The central portion of the tube is provided with a protective lead band for preventing egress of rays except at the window. Also, in order to direct the beam in any desired direction, the insert tube can be rotated on its own axis independently of the earthed casing and cables.

The tube filament is heated by means of conductors centrally disposed within one of the cables, while the anode is cooled by water flowing through ducts centrally disposed within the other cable.

The tube is supported on a stand which enables it to be moved up and down and to and fro for convenient positioning with respect to a patient in any posture.

ROTATING ANODE TUBES

The problem of providing a large effective area on the anode of an X-ray tube for dissipating the energy expended in the bombardment by electrons has been tackled in an interesting way in one form of tube by making the anode rotate. This affords a means of offering to the electron stream a constantly changing area of metal, any element of size equal to the focal spot receiving the bombardment once in every revolution of the anode. This effect is obtained by arranging the anode in such a position that the cathode stream is trained on an eccentric area of the anode as shown in Fig. 176. The rotation of the anode (with the cathode stream in a constant position)

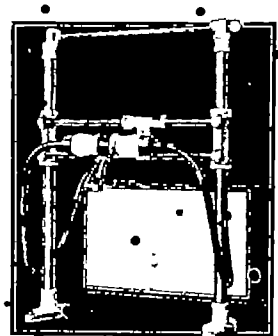


Fig. 175.—A Philips shock-proof X-ray tube mounted on tube stand. Tube output 200 K.V., 10 m.A.

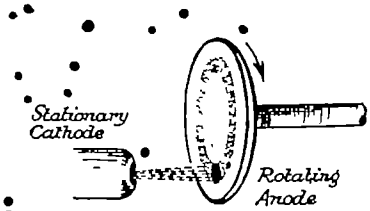


Fig. 176.—Diagram showing how cathode stream impinges upon a rotating anode with small focal spot but large focal track and correspondingly large heat conducting area.

means that a circular path on the anode face actually receives the electron bombardment, and consequently a comparatively large volume of metal behind the anode face is available for conducting the heat away from the circular path.

Of course, in a short time the whole of the anode metal reaches a high temperature which it is impossible to exceed without danger, and this time represents the maximum exposure time for the tube. A period of rest is then required. No artificial form of anode cooling such as oil or water circulation is used with the rotating anode tube. The rotating anode is not designed for continuous running, but the principle permits employment of heavy instantaneous loads on the X-ray tube for such work as chest radiography in which movement is liable to spoil a picture unless the exposure time is very short.

The anode rotor takes different forms in different manufacturers' designs. In the Siemens and Victor types for example (Fig. 177), the rotor is of disc form with a slender shaft while the Philips " Rotalix " tube has a rotor of hollow cylindrical shape.

The rotating system is constructed to have as great a thermal capacity as possible. The fact that the rotor has to run in ball bearings means that there is little possibility of heat conduction, so advantage is taken of the principle of dispersion of heat by radiation to a big body of metal forming part of the tube structure.

The rotation of the revolving member is obtained by inducing in it eddy currents from stator windings arranged around it. These windings are mounted on the outside of the tube and, being at a near-earth potential, can be connected to the mains.

CONTINUOUSLY EVACUATED X-RAY TUBES

One of the difficulties associated with X-ray tube manufacture is the production and maintenance of a high vacuum within the envelope. Exhausting apparatus and technique have been developed to such a high degree of excellence that the difficulty has been minimised and a tube, when taken off the pumps and sealed, has received so many treatments for " outgassing " the envelope and electrodes and for thoroughly evacuating the air from the envelope itself that it will run throughout its life with a

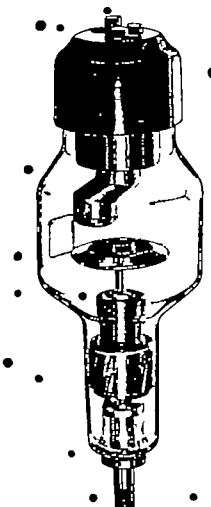


Fig. 177.—Rotating anode tube of Coolidge type. (Victor X-ray Corporation).

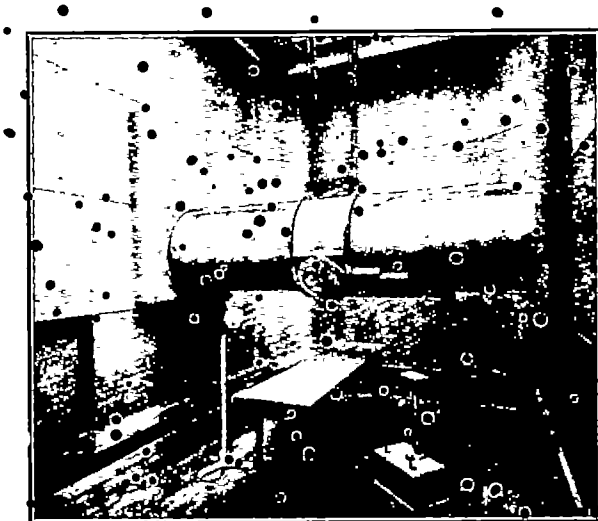


Fig. 178.—The treatment room of the Moselle Sassoon High Voltage X-ray Therapy Department, St. Bartholomew's Hospital, showing X-ray tube and couch.

stable vacuum. During use, however, an X-ray tube is liable to release gas from one or other of the components subjected to heating, specially if such heat is local.

For some special tubes therefore in which high loads or extra high voltages are used, the principle of continuous evacuation is adopted. With this scheme the X-ray tube is not removed from the pumping system and sealed off, but is subjected to evacuation all the time that it is in use, specially designed pumps being employed which can operate at high voltage.

A famous example of this type of installation is the X-ray tube at the Mozelle Sassoon High Voltage X-ray Laboratory at St. Bartholomew's Hospital. An illustration of this " million volt X-ray tube " is shown in Fig. 178.

This tube, the most powerful in the British Empire, is some 30 feet long, and has a central portion 12 feet long in the treatment room (seen in Fig. 178) the ends projecting on either hand into rooms where the high voltage generators are housed. The central portion of the tube in the treatment room is surrounded by lead protection to prevent radiation emitted from the tube, except at the window. The position of this tube is fixed, but the cylindrical casing can turn on its own axis. The floor of the room is movable so that the position of the patient relative to the tube may be adjusted as required. The tube operates at about 1,000 K.V. and 4 m.A.

The higher the voltage the shorter is the wave-length of the X-radiation, and at a million volts the wave-length approaches that of the gamma rays of radium.

An advantage of X-ray tubes continuously evacuated is that, if any damage occurs to filament or anode, it is a comparatively simple and inexpensive matter to dismantle and replace by new components. On the other hand in " sealed-off " tubes a damaged internal component generally means a completely new tube, and this is a costly matter. For most purposes, however, the " sealed-off " tube is so much more convenient and its life so reasonably long that it is in general use.

AN X-RAY TUBE FOR MILLION VOLT WORKING

Although a potential difference of a million volts is an unusually high one at which to operate an X-ray tube even in deep therapy, a " sealed-off " model has been developed by Messrs. Philips. This tube is six feet long and comprises three sections joined together lengthwise, each section corresponding to a potential difference of one third of the total (333 K.V.), the potential difference being controlled by parallel resistances. The comparatively short length (6 feet as against 30 feet in the continuously evacuated tube at St. Bartholomew's Hospital) is achieved by special design features including increasing the effective surface length with double re-entrant glass-work and the use of large disc-shaped barriers between the sections. The tube operates continuously at 1,000,000 volts, and 1 milliampere. The anode is at one end and is enclosed in a thick pear-shaped lead jacket for preventing emission of rays except at certain windows. A deep therapy X-ray department incorporating one of these tubes is installed in a hospital in Amsterdam.

X-RAY TUBES FOR INVESTIGATING ATOMIC STRUCTURE

Besides being used for obtaining shadow pictures such as in the ordinary radiograph and fluorescent screen image, X-rays are used for the investigation of the atomic structure of materials. Although this work is more in the realm of physics it should be stated that experiments are in progress for the extension of the work in the medical field. For example, the structure of human hair has been investigated and attempts have been made to relate the form of the structure to the physical condition of the patient.

It is not proposed here to give any details of the complicated and highly specialised technique employed in this work, but the general principle is that, if the beam of

X-rays be made to fall upon the specimen being investigated, the beam may be "reflected," and the intensities and angles of the reflections from the minute atomic components of the specimen are dependent upon its atomic structure.

Now, whereas the voltage applied across an X-ray tube may be said to govern the *limiting* wave-length (at maximum voltage, minimum wave-length), the material of the anode target governs the *characteristic* wave-length, i.e., a particular wave-length at which there is an abundance of X-rays. Thus, anodes of tungsten, molybdenum, rhodium, copper, etc., emit different characteristic X-radiations.

Specific characteristic radiation is appropriate to the investigation of the atomic structure of particular materials, and therefore X-ray tubes having anodes of different materials are necessary. An economical way of dealing with this necessity is to employ one tube of the continuously evacuated type and a number of anodes each of which may be fitted to it.

When a change of anode is required the procedure is to dismantle the anode end of the tube, assemble the new anode and re-exhaust.

If continuous evacuation is undesirable, research tubes for work of the character suggested above may be constructed partly of metal and provided with special fittings for joining on to exhausting apparatus and subsequent easy sealing-off with the aid of special sealing-wax.

CORRESPONDENCE

Letters are welcomed on all matters of general interest. Publication does not necessarily imply that the Editors agree with the views expressed.

To the Editor,

The British Journal of Physical Medicine.

"The Secret of Life"

Sir,—Dr. Turrell's review of the "Secret of Life" is more impressive by its discursiveness than by its fairness. Four full pages in the August number of the *British Journal of Physical Medicine* are devoted to what Dr. Turrell, in a brief flash of impartiality, describes as "this remarkable book." For indeed it is a remarkable book. Graciously sponsored by Professor d'Arsonval and translated into five languages, it becomes at once apparent to anyone that it must be a work of outstanding merit, whatever its defects may be from the point of view of orthodox science.

In spite of indisputable evidence in the form of Hospital records and photographs, Dr. Turrell seems loath to accept the results obtained by means of Lakhovsky's Multiple Wave Oscillator. The fact that the cosmetic effects resulting from this mode of treatment are incomparably better than those obtained by other methods impels him to make the comment that "such cosmetic effects would delight any beauty parlour."

Dr. Turrell complains that a full technical description of Lakhovsky's Multiple Wave Oscillator is not given in the text, and possibly he would like to have seen a detailed diagram of the whole circuit. Dr. Turrell must be singularly naive to expect the emergence of the multiwaved cat out of the electrical bag. The Patent Office in London has recognized Lakhovsky's brilliant invention as a master patent, that is to say, there is no record of its ever having been anticipated. Lakhovsky's Multiple Wave Oscillator is patented in Great Britain, France, Germany, Belgium, Holland, Italy, and many other countries. In the circumstances it is not customary to reveal the mechanism of the apparatus in a book mainly intended for the lay public. But Dr. Turrell, in his capacity of expert electro-therapeutist, is welcome to inspect the apparatus himself, to examine it from every conceivable angle, and, above all, to test its therapeutic efficiency.

Dr. Turrell's review, being anything but an impartial criticism of the clinical results preserved in the "Secret of Life," gives an entirely false impression of the practical possibilities of Lakhovsky's Multiple Wave Oscillator, and his attitude is in contrast with that of his world-famous contemporary, Professor d'Arsonval, who in his old age was imaginative enough to sponsor Lakhovsky's so-called revolutionary theories.

The remarkable clinical results obtained by means of Lakhovsky's Multiple Wave Oscillator by medical investigators on the Continent are now being confirmed in this country, and their significance is such that medical men and electro-therapeutists will soon realize that, in practice, it is not theories that count, but results.

Finally, Dr. Turrell may be interested to learn that there are now over 200 Lakhovsky's Multiple Wave Oscillators in use in clinics and hospitals throughout the world. The French Government, which is notoriously averse to spending money on public services, has recently ordered 100 Hospital models of Lakhovsky's Multiple Wave Oscillator for hospitals in their Northern African territories.

MARK CLEMENT.
(Translator of "The Secret of Life.")
London, October, 1939.

CONTEMPORARY PHYSICAL MEDICINE

Abstracts from Recent Literature

VILLOUS SYNOVITIS OF THE KNEES DUE TO IMPROPER WEIGHT DISTRIBUTION

It is generally recognized that improper distribution of body weight is a cause of painful synovitis of the knee. J. P. Stump and W. H. Irish (*Arch. Phys. Ther.*, 1939, 20, 321) consider that this condition is frequent and often overlooked. Injured cartilages and joint mice are the most likely diagnoses applied to these patients before detection. By taking into consideration the anatomy of the knee-joint it is understandable why faulty weight distribution causes synovitis. The weight is transmitted from the articular surfaces of the condyles of the femur to those of the tibial head, gently cushioned and balanced by the semilunar cartilages. The lateral and cruciate ligaments help in maintaining further balance, the joint capsule, and the hamstring muscles posteriorly and the quadriceps femoris anteriorly all contribute to the maintenance of balance. In patients with weak feet the weight distribution causes abnormal stress on the joint capsule, on the muscles, and on the cruciate, and particularly the internal lateral, ligaments. The close relationship of the cruciate and internal lateral ligaments to the synovial membrane results in a constant irritation of the membrane by prolonged trauma. An inflammatory reaction with hypertrophy follows; the villous formation is the end result of this vicious circle. X-ray examination of the knees shows nothing abnormal, though there is often a thickening of the soft tissues and a haziness in the joint space. The symptoms of the condition are insidious, and it can be said that a slowly increasing pain is usually present in all cases. The knees are stiff after rest, and pain increases on walking and standing. The first movements are very painful, but the pain subsides after a time, though often the patient has to abandon the attempt and repeatedly try again before he can walk. The knees become large and misshapen, giving the impression of nodular exostoses on the femur and the tibia. In the treatment of the condition the strain on the supports of the medial sides of the knees must be overcome. Deep heat, and quadriceps faradization of the quadriceps assists support and stabilization of the joint; attention must then be directed to the correction of postural abnormalities.

FANGO THERAPY

E. G. Vertiak and D. Kobak (*Arch. Phys. Med.*, 1939, 20, 487), at the last American Congress of Physical Therapy, reported on 25 cases of previously treated chronic arthritis which were subjected to fango applications only. All these patients had had their disability for a few years, but none of them had improved from any previous form of treatment. All but 5 patients improved considerably under fango treatment, and in this article the authors report on a second series of 25 cases which, in addition to fango treatment, received medical treatment and attention to their septic foci, etc. The removal of foci was found to be of importance, as far fewer fango applications were necessary to maintain freedom from symptoms. In 7 patients who did not agree to the removal of their tonsils little benefit was obtained. Of the 25 cases, 10 showed marked, and 15 moderate, improvement.

REVIEWS of BOOKS on Physical Medicine and Allied Subjects

Rheumatism

Rheumatism. By H. Warren Crowe, D.M. (Oxon), B.Ch., M.R.C.S., L.R.C.P., 258 pp. Price 12s. 6d. London, 1939, John Bale Medical Publications, Ltd.

In his preface, Dr. Crowe points out that his book is written for the benefit of those who wish to take an active part in the treatment of the chronic rheumatic diseases. He states his conviction that in every case of rheumatism and arthritis there is an infective factor, and that, since treatment in his Clinic, the Charterhouse Rheumatism Clinic, " has become almost automatic in its application, there is no excuse for the non-employment of vaccine therapy, and that it is only in some 20 per cent. of cases that this method fails, and it is necessary for the medical practitioner to try other methods."

In his chapter on General Nomenclature and Classification, Dr. Crowe mentions certain recognized groupings, which are in general use, and describes in detail a somewhat complicated classification to which he refers as " The American Committee's Table." He refers to the importance of differential diagnosis: "that it is possible to differentiate rheumatism occurring in joints from true osteoarthritis by means of the patella sign. This sign is elicited by pressing the patella from side to side, the limb being relaxed, and noting where the cartilaginous surfaces are perfectly smooth or where there is any suggestion of roughness." . . . " The group ' early osteoarthritis ' depends on this sign alone, and is otherwise entirely undistinguishable from muscular rheumatisms or fibrositis." This differential clinical sign has not been confirmed by other workers. The " pathogen selective test " and the " differential sedimentation test " are used as laboratory methods of differential diagnosis and for the assessment of clinical results. Much stress has been laid upon them, but they also do not appear to have come into general use among pathologists.

If the reader is somewhat unhappy as to the reliability of these different tests, he need not, however, fear that it will affect the success of his treatment, because the author claims to obtain the vast majority of his successes in a quite undifferentiated group of rheumatic troubles by means of a stock vaccine.

Chapters which follow describe in detail the so-called infecting factors and the method of vaccine treatment which the author has applied for some years. The evidence that is put forward and the reasons which are given to the reader are of a somewhat childlike and uncritical nature. For instance, he cites as a " quite conclusive indication of the value of the vaccine treatment, that many severely crippled patients have continued to come to the Clinic for injections at varying intervals up to as much as three months, because their pains, when they occur, are immediately banished by a single injection of vaccine of the magnitude to which they have been accustomed. This is in itself the most convincing proof of the value of vaccine therapy that could possibly be advanced, much more than so-called reputed 'cures.' "

Chapters are devoted to the detail of vaccine therapy, dosage, reaction, and so forth. There follows a chapter on rheumatism as a national problem, in which the author states that, at the Charterhouse Rheumatism Clinic, approximately 500 people are treated a week, 400 receiving only stock vaccine injections, the remaining 100 being thoroughly investigated and receiving autogenous vaccine. The author claims that there is no need for skilled physiotherapeutics. Apart from vaccine therapy, some massage, local heat, and good feeding are all that are likely to be required. He suggests that the majority of people in this country should be offered a cure of their rheumatism by the routine application of a stock vaccine, and that by this means for a comparatively small sum of money the rheumatic problem could be tackled successfully.

Certain of Dr. Crowe's colleagues at the Charterhouse Rheumatism Clinic have contributed interesting chapters. Dr. Gilbert Scott writes on the place of X-rays in the treatment of chronic rheumatic disease. He describes his technique of wide-field X-ray therapy, and

claims good results. His work, however, has not yet been confirmed by other radio-therapeutists who are treating rheumatic patients. Mr. Fripp contributes a short and orthodox chapter on the orthopædic aspect of this disease, and Mr. Beauchamp one on manipulation. Laboratory technique by Mr. P. Atkins, and physiotherapy by Miss Helen Anderson, are dealt with in two short chapters.

The late C. C. Okell, Professor of Bacteriology, University College, London, wrote in the "Reports of Chronic Rheumatism" in 1937 on vaccine and rheumatoid arthritis: "We are first asked to believe that by injecting dead bacteria, a method apparently without any curative value in any human or animal disease, we can benefit a disease the etiology of which is entirely unknown, and which, for all we may know, may not be a microbic disease at all." It would be only fair to the author of this book to suggest that this is somewhat too dogmatic a statement. Undoubtedly vaccines have their place in the treatment of the rheumatic diseases. Excellent clinical results have been obtained by Dr. Crowe and others who have applied them to their rheumatic patients. The extent to which this is due to psychological rather than biological factors, none of us is in a position to judge.

It is unfortunate that a man in Dr. Crowe's position should have produced a book of this character. He is recognised as one of the leading exponents of vaccine therapy, and has done pioneer work, much of which is excellent. This book may be considered as reasonably good showmanship, but surely it cannot be considered as a reasoned and authoritative account of his work such as he would wish to present to his medical colleagues in general practice? At the present time, when such serious endeavour is being made by medical men and laymen to tackle the problem of rheumatism, it would be a cause of great regret if a book such as this, which makes extravagant and dogmatic claims based on unconfirmed laboratory work and uncontrolled statistics, should be accepted as a textbook, and its blunderbuss methods applied, in the place of careful clinical investigation and the practice of the physician's art.

F. B.

Ultra-Violet Therapy

Les Sources de Rayons Ultra-Violets. Leur Utilisation en Pratique Journalière. By Jean Saidman. 291 pp., 120 illus. Price 75 francs. Paris, 1939. G. Doin et Cie.

This volume is written by an acknowledged authority on the subject of actinotherapy, who has himself contributed greatly, both by improvements and by new apparatus, to the technique. We have grown to expect of the French authors clear, lucid expositions, and in this book the reader will certainly not be disappointed.

In his preface Dr. Saidman states that he is striving to reply to the demand of numerous practitioners who wish to use their radiation sources in a less empirical manner.

The subject matter of the book falls quite naturally into three parts. In the first part is described the qualitative emission of radiation by various sources. Much emphasis is placed on this throughout the book.

Chapter I gives a brief survey of the fundamentals of radiation and its methods of study, and is reinforced by fascinating diagrams illustrative of the text. Mention is made of various physical apparatus used in precise investigation of the ultra-violet rays.

Three chapters are devoted to the principal types of lamp used for the emission of ultra-violet. Open-arc lamps are discussed as regards their electrical operation, their construction and their output of useful radiation. A number of such lamps available on the French market are individually described and illustrated.

The following chapter covers the mercury-vapour lamp in its many constructions and types. Some, indeed, are strange and now obsolete examples of the lamp makers' art, but nevertheless all are of interest if only to show the progress in this field. Attention should be drawn to a misprint, on page 78, in the diagram showing 110 and 220 volt tilting-type burners. Actually the figures in the text are reversed, since it is the shorter tube which operates from 110 volts. Again, much emphasis is laid upon the radiation from these lamps, and a description is given of marketed types. The chapter closes with some observations on the correct functioning of this type of lamp.

Miscellaneous sources are discussed in Chapter V in relation to their emission of radia-

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tion within the ultra-violet regions A, B and C. Details are given of some filters for the isolation of particular bands.

Chapter VI describes various methods of localizing the zone of irradiation by concentrators, applicators, and reflectors.

The second section deals with the quantitative output of radiation, and begins with a chapter on physical and chemical measurements. The next chapter on biological measurements is one which should be read by every user of ultra-violet light There are short sections on abiophotometry, animal irradiation, and photo-activation, and the remaining 33 pages are devoted to skin tests. Suitable apparatus is discussed, and there is a multitude of authoritative observations on the recognition of types of erythema, and how this differs in different patients.

These first and second sections of the part are rounded off with some sound advice on the choice of a lamp, according to the principles outlined in the preceding chapters.

In the remaining 77 pages of the book the author describes the technique of irradiation for collective, general, and particular treatments. Indications and examples are given of the method of prescribing treatment times, with useful hints on dosage. Special sections are devoted to dermatology, children's complaints, tuberculosis, miscellaneous surgical cases, and the treatment of mucous membranes.

This book can be looked upon as a noteworthy addition to the library, not only of the practitioner who is already using ultra-violet sources, but also of the doctor who desires an authoritative introduction to this branch of physiotherapy.

F.G.A.H.

POPPY DAY APPEAL

Although this issue will not be published until Poppy Day, 1939, is past, we wish to draw our readers' attention to the advertisement on the inside back cover of this issue, and to remind them that donations can be sent at any time.

ST. DUNSTAN'S WAR AIMS

Men and women of the Army, Navy, and Air Force, and members of the Regular Fire Brigades and Police Forces who may be blinded in the present war, will be cared for by St. Dunstan's. This was arranged before the war in a series of Conferences including representatives of the Fighting Services, the Ministries of Pensions and Health and St. Dunstan's.

It was agreed that St. Dunstan's should establish a War Hospital for serious eye cases and other incidental wounds as an integral part of its organization, and that the authorities concerned would concentrate the cases there so soon as they could be moved. Great importance is attached to early training of the newly blinded.

A year ago St. Dunstan's completed the building of a Convalescent Home on the Sussex Downs, near Brighton. The Home has now been converted into a War Hospital capable of taking 200 patients, and a small but perfectly equipped operating-theatre block, containing the most up-to-date ophthalmic theatre and general theatre, is rapidly nearing completion. This theatre block, together with the incidental expenses of the conversion, at a total cost of £7,000, was the generous gift of Lord Nuffield. Surgeons and Sisters from Moorfields, the famous London Eye Hospital, are in residence. A temporary theatre is ready, and the Hospital is fully staffed with orderlies and auxiliary nursing personnel.

Meantime, the blinded veterans of the Great War are enjoying periods of treatment or convalescence at the Hospital, which remains for them the Home it has always been. St. Dunstan's will remain a voluntary agency, supported by the good will of the British peoples, and this good will will be called upon by public appeal, which will take many forms. To help start a War Fund, 10 per cent. of the nett proceeds of this year's Poppy Day will be allocated to St. Dunstan's.

Plans are in hand as the need arises to extend the Hospital and to enlarge the present school, so that all the young blinded men may learn to read with their fingers, to typewrite, to look after themselves and walk alone, to learn as little children do the first lessons of life.

The new St. Dunstan's may be different in many details from that of a quarter of a century ago, but the spirit will be the same, and "Victory over Blindness" will be the watchword.

THE SOCIETY OF PHYSIOTHERAPISTS

REGISTER OF PHYSIOTHERAPEUTIC SERVICES AND EQUIPMENT.

The response from members of the Society in reply to the letter and form recently circulated concerning the above has been most gratifying, and the Executive Committee wishes to thank members for their prompt replies, which will enable them to give the Ministry of Health a very representative list of physiotherapeutic services and equipment available through members of the Society of Physiotherapists. Those members who have not so far returned their forms are requested to do so without delay, if they wish their facilities to be included in the list.

Published with this issue of the *Journal* is the Society's *Supplement* (issued to members only). The Committee asks members to read this carefully and to offer any criticisms or suggestions concerning the matter it contains. The next meeting of the Committee will be held on Thursday, November 30th, at 1.30 p.m., at 159, Victoria Street, London.

In common with the majority of the community, the activities of members of this Society and their professional colleagues have been considerably disorganized and curtailed during the preliminary weeks of the war—especially those who practise in the large towns. This unhappy position was to be expected on account of the evacuation scheme and the emergency economy measures taken in so many professions and industries as well as by private individuals. We do not think, however, that this state of affairs will be prolonged so far as physiotherapy is concerned—in fact, we believe that physical medicine will be of great service in this war because of its greater known utility both as a preventive and therapeutic agent, and, while we know how difficult it must be for many of our members to maintain their clinics and treatment-rooms on account of the lesser demand for their services during the past weeks, we hope that they will be encouraged to do so as long as possible.

Since the last war considerable progress has been made in physiotherapy and in the organization of services for its proper administration, and we have no doubt that in due time it will prove its value in the treatment of war casualties as well as in the treatment of civilians who become debilitated as a result of war conditions.

THE BRITISH JOURNAL OF

PHYSICAL MEDICINE

AND INTERNATIONAL REVIEW

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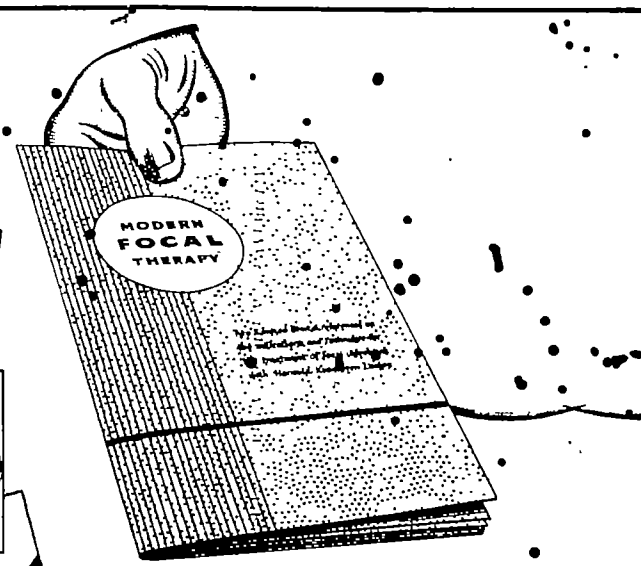
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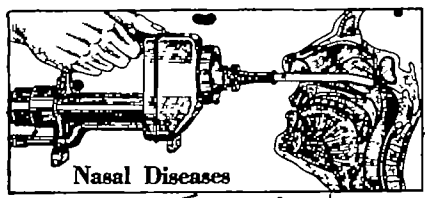
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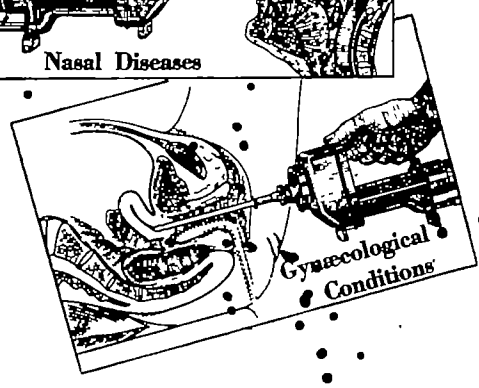
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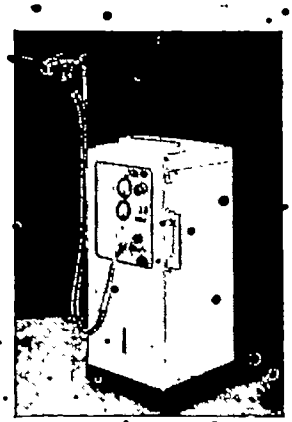
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THE BRITISH JOURNAL OF PHYSICAL MEDICINE

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SOME ADVANCES IN PHYSIOTHERAPY

AS is to be expected from a young and vigorous subject, physical medicine continues to make interesting and important advances. Some of the more recent of these have been outlined by F. H. Krusen (*Physiother. Rev.*, 1939, 19, 316).

With regard to ultra-violet irradiation, a fascinating application has been that of sterilizing the air in hospital wards, corridors, and operating theatres. On the basis that air-borne infections are not uncommon, Wells (*Mod. Hosp.*, 1938, 51, 66) suggested the irradiation of recirculated air in ventilating systems with ultra-violet light, and stated that direct irradiation of the air of the whole room is even more effective, suitable measures being taken to protect the eyes of occupants. Hart (*J. Thoracic., Surg.*, 1938, 7, 525) carried out a series of 132 operations (extra-pleural thoracoplasties) on 59 patients in a field of air sterilized by ultra-violet light and, comparing the results with those from 110 similar operations, found that the mortality was reduced by 50 per cent., as a result of elimination of severe infection of the wounds. The wounds healed more rapidly, post-operative pain was decreased, and convalescence was more rapid.

The valuable applications of fever therapy have frequently been noted in this *Journal*. An important recent development has been the realization that better results are often obtained in certain infections, such as gonorrhœa, by a combination of fever therapy and chemotherapy (e.g. sulphonamide drugs) than with either method alone.

In the sphere of short-wave therapy, Bennett at the Mayo Clinic has recently evolved an improved method of treating conditions associated with peripheral vascular spasm. His technique consists in the application of four turns of an induction cable in pancake formation over the lumbo-sacral region, the coil being spaced by means of Turkish towelling at least one or two inches from the body surface. The current is increased until the patient experiences a sensation of comfortable heat, and the session lasts for an hour or more. The room temperature is kept at between 80 and 84° F. With this treatment a marked vasomotor response is frequently obtained, with a considerable increase in the temperature of the extremities.

With regard to the use of contrast baths in rheumatoid arthritis, Woodmansey *et al.* (*Lancet*, 1938, 2, 1350) have shown that the usual method of employing these baths, by alternating periods of one minute, is not satisfactory. After careful clinical experimentation, they found that the optimal degree of active contraction and relaxation with increased flow of blood is obtained when the hot bath is applied for six minutes and the cold for four. Krusen, at the Mayo Clinic, employs a five-minute exposure to hot water and a two-minute exposure to cold.

In the realm of mechanotherapy may be mentioned the tilting bed, controlled mechanically, which alternately raises and lowers the patient's legs, thus aiding the circulation therein. This is employed with good effects in certain types of cardio-vascular disease.

To these advances described by Krusen might be added many more to show beyond doubt that physical medicine is progressing steadily, and making contributions of real value to every branch of the science of healing.

THE PENETRATION OF RAYS THROUGH THE SKIN AND RADIANT ENERGY FOR THE TREATMENT OF WOUNDS*

By SIR LEONARD HILL, M.B., LL.D., F.R.S.
Director of Research at the St. John Clinic and Institute of Physical Medicine.

ACCORDING to the quantum theory a point source of radiation emits " particles " of energy, called photons, which travel in a vacuum in straight lines uniformly in all directions at the velocity of light; the intensity of such radiation received by a material is inversely proportional to the square of the distance. It is important to remember, then, that halving the distance quadruples the intensity, for example, of an arc light acting on the skin. When the source is large compared to the distance of the receiving material, for example a radium plaque, the law does not apply. The shorter the wave-length according to the electro-magnetic theory the greater the energy of radiation. The interaction of matter and radiation is an atomic phenomenon. An atom is conceived as a nucleus surrounded by electrons spinning in various orbits and bound to it. The energy of short-waved radiation is transferred to electrons which, being displaced and being negatively charged, attach themselves to other atoms thus forming negative ions, while the atoms deprived of electrons form positive ions. Ionization, so produced, starts chemical reactions, since, through thermal agitation and the force of attraction between oppositely charged ions, there results the formation of neutral atoms. The tendency of radiant energy is to transform complex into simpler elements or compounds. Through absorption of a small amount of radiant energy chemical changes may result within the living cell, thereby setting free more energy. Radiant energy is transferred to the cells only by absorption and interaction of radiation with matter. If the cell is transparent to a particular wave-length this has no effect upon it. The retina of the eye has been evolved as a receptor of light radiation, of extreme delicacy, being sensitive to a few quanta of energy, an inconceivably small amount. The realization of the fact that the sense organs have been evolved to put us in relation with the environment enables one to reject all forms of witchcraft such as telepathy, polytergism and dowsing. There are no mysterious rays producing effects which are outside scientific law and explanation.

The fact that radiation produces in living cells first ionization, then chemical change, and finally alteration in the living state explains the latent time which precedes the effect. For example, sunburn results not at the time but some hours after exposure of the white skin to the mid-day sun. Be it noted that every ionization of atoms resulting in chemical change need not influence the stability of the living cell. There must be a certain intensity to produce an effect, and weak intensity with prolonged exposure does not give the effect of stronger intensity with shorter exposure. For the cell to be affected there must be penetration and absorption of the radiation and a certain threshold of intensity. The very shortest rays of the sun, which come through the atmosphere, are those which produce sunburn, but this is only superficial, because these short ultra-violet rays have very little power of penetrating the skin, and exert their effects, therefore, only on the living cells which lie just beneath the horny layer of the epidermis. The skin protects itself by thickening the horny layer. Similarly protection against light rays which, reaching the cutaneous blood vessels are absorbed by the blood, is gained by the brown pigment which forms in the cells of the epidermis as the result of exposure to the sun. The reaction of the living cells of the skin to injury

*A paper read before the Royal Society of Arts on Wednesday, November 22nd, 1939.

are alike whether produced by a blow, irritant poison, or irradiation; there results a primary active dilatation of the minute blood vessels of the derma followed by a more wide-spread flare due to opening up of the arteries, accompanied by œdema, the classical reactions of inflammation. Reflex effects may be evoked by way of the nerves and affect deeper parts, and metabolites, such as histamine-like substances, absorbed from the injured parts may affect the whole body. Irritation of the skin, whether produced by ultra-violet rays, heat, blistering fluid, flagellation or other means, causes more blood and lymph and leucocytes to be brought to the irritated area, and there takes place absorption of damaged products followed by processes of repair. The skin thereby stimulates the immunizing power of the body.

X-RAYS AND RADIUM

Cosmic rays coming from the universe, gamma rays from radium, X-rays, ultra-violet, visible, infra-red rays and "ultra-short" waves used in wireless form one continuous spectrum of electro-magnetic waves, the various regions of which differ only in wave-length, the cosmic, gamma and hard X-rays being inconceivably short and the rays used in radio many metres long. Cosmic rays have great power of penetration. Such as are absorbed by the body may expel electrons from atoms, but there is no evidence that they have any appreciable effect. It has been suggested that, by action on the reproductive cells, cosmic rays may cause mutations to arise. There is no proof of this, but a certain intensity of gamma and hard X-rays can produce changes in the chromosomes of ova, whence mutations do arise. Cells in a state of division are the ones most sensitive to these penetrating rays. Cancers such as have cells actively dividing are affected more than normal tissues. Hence the use of these rays for treatment of cancer; but large doses produce destruction of normal tissues such as marrow and lymphoid tissue, leucocytes, and epithelial linings, and death ensues. The latent time for signs of damage produced in the skin by X-rays is two to five days, and by the gamma rays of radium two to three weeks, indicating the time it takes for the secondary changes in the living cells to appear. Workers exposed to X-ray or radio-active substances suffer from dermatitis, and cancer may result, as it has, from the accidental leaving of a radon tube in the body. Cancer of the lung occurs in high degree in miners who extract pitch-blende, the ore from which radium is obtained. The use of radium for treatment of cancer has resulted, in not a few cases, in the production of intolerable and unrelievable neuralgia. It is claimed that modern X-ray methods can do all that radium does, and that dosage can be much better controlled. Since the discovery of radium by the Curies, who made not one penny out of its exploitation, enormous sums have been paid to those who have worked radium-bearing ores and placed it on the market for curative purpose. Now, after many years of experience, many would choose the knife or X-rays for treatment of cancer. The world would, I think, be little the worse off if all the radium in the country, now buried in deep holes for security from bombing, remained therein. Very big monetary influences will cry out against this.

We all know how X-rays, when used at first by men ignorant of its dangers, produced burns, difficult to heal, and cancer. There has been put on the market apparatus for producing very weak radio-active water to be taken by the mouth or injected under the skin; radio-active pads for external use are also advertised widely. Factory hands have died through licking brushes when applying a luminous radium paint to dials of watches. The dosage of radium then to be safe has to be very small. The evidence shows that radium in intensity sufficient to produce an effect is always harmful to living cells. It is claimed, however, that very small concentrations such as exist in some spa waters have a beneficial effect, but there is no evidence that spas with a higher content give better curative results than those with a low one. Radio-active pads on the market contain a little of the crude mineral ore from which radium is isolated. This

costs a few pence, but the pads are sold for ten guineas, and, if electrically heated, for twenty guineas. An electrically heated pad which is obtainable from any store for about thirty shillings will give all the curative effects of the twenty-guinea pad. The credulity of people about mysterious ray influences is astonishing, and they ought to be protected from the rapacity of those who take advantage of their ignorance. One kind of fraud is punished severely by the law, and another let go scot free.

ULTRA-VIOLET RAYS

Ultra-violet rays, similar in action to that of the shortest rays of the sun, are afforded by carbon arcs and mercury-vapour lamps. The former can be reinforced by the use of iron or tungsten in the poles. These rays sterilize the air and the skin surface when in sufficient intensity. Owing to their slight penetration of, and absorption in, the epidermis, their effect is limited to the living cells therein and the capillary loops of the derma just beneath. After a latent period of a few hours the skin is reddened, and fluid and leucocytes infiltrate the exposed area, and, if the dose is intense, blistering results. The distribution of blood, lymph, and leucocytes to a wound and the sterilizing effect has a very beneficial result; the dose must not be too strong or the healthy granulations will be damaged. By inducing such reactions these rays have the effect of causing carbuncles and boils. To effect this result an intense dose is given to the inflamed area. Similarly *lupus vulgaris* is cured by the immunizing power of the blood determined to the diseased area by frequent intense doses of ultra-violet rays. The rays can also be used as a blistering agent for relieving sciatica and other painful conditions. elastoplast bandage being applied immediately after irradiation so as to protect the blistered skin and prevent irritation. There are various skin diseases, acne, eczema, alopecia areata, etc., which respond well to ultra-violet ray treatment. One of the most remarkable actions of the short ultra-violet rays is the production of vitamin D in the skin which is necessary for the growth of bones and protection from rickets. By adequate irradiation, by sun or arc lights, and a supply of calcium and phosphorus salts in the diet rickets can be prevented. Light stimulates breeding in birds, mice and monkeys, and the introduction in the Zoo of artificial sources of such at my suggestion has facilitated the keeping of tropical birds, lizards, monkeys, etc. That great pioneer Bernhard, of St. Moritz, at the beginning of this century, began to use light and open air for treatment of wounds, and showed in the Great War how it was possible to conserve severely injured limbs which would have been amputated by other surgeons. He used a solution of iodine to clean the wounds in all their depths and ramifications, and then exposed them to sun and air by day, covering them with a layer of gauze by night. To keep flies off, a covering net was used. Losing hardly any lives from tetanus or gangrene he secured the healing of dreadful wounds. All that he did at St. Moritz can be done here by means of artificial sources of radiation, but our surgeons remain indifferent.

INFRA-RED RAYS

The short infra-red and red rays are of particular value as well as the ultra-violet rays. How far the red rays penetrate can be seen by putting a glow lamp in the mouth in a dark room in front of a mirror, when a faint red glow will be seen to come through the cheek of a white, but not through that of a black, man. Irradiation, by bringing blood into a painful part and warming and relaxing the tissues, lessens tension of the nerve endings and relieves pain. The pain that may follow extraction of a tooth can be relieved, for example, by irradiation of the gum. For fibrositis, rheumatic affections of joints, lumbago, the pain accompanying herpes zoster, etc., radiant heat is most effective.

The longer infra-red rays do not penetrate the epidermis, but warm the surface of the skin whence the heat is conducted. It has been claimed that the penetrating red and short infra-red rays coming from luminous sources heat the subcutaneous

layer even more than the surface, but researches now being carried out by Dr. H. J. Taylor and myself show that a very sensitive thermo-electric junction introduced as a needle into the substance of the epidermis is, in fact, heated a little more than a similar junction inserted subcutaneously beneath the derma. In the case of a dark heat source, the rays of which are non-penetrating, the surface is heated notably more than the subcutaneous tissue. I have made the discovery that dark sources of heat such as steam pipes and stoves, and dull red sources, such as electric fires, by reflexly causing congestion of the mucous membrane of the air passages of the nose and lungs, tend to narrow these. Bright luminous sources have the opposite effect, the greater comfort of such sources felt by many people being thus explained. The stuffy feeling of warm rooms is due largely to the character of the radiation. The stuffy feeling in crowded rooms has nothing to do with the chemical quality of the air, neither the carbon dioxide being increased nor oxygen diminished sufficiently in such rooms to have the least physiological effect. Ventilation by cool air counteracts the stuffy effect of long infra-red rays. A greenhouse heated by the sun feels stuffy compared with the open air, because the sunlight is absorbed by the objects within and turned into dark heat, and this is trapped by the glass, while there is no movement of cool air. My work has been confirmed by W. R. A. Thomson and by Dutch and German research workers. It has been shown by the latter that dark heat rays also cause a reflex dilatation of skin areas other than that irradiated, while bright sources have the opposite effect. The difference is to be ascribed to the greater warmth of the surface of the skin produced by the dark heat sources. By acting on the epidermal nerve endings this surface warmth produces the reflex effects. It is claimed that 1 mm. of flesh is penetrated by 0.5 per cent. of the rays from a dark heater, 15 per cent. of those from a carbon arc, and about 30 per cent. of those from a tungsten arc or the sun. The visible rays, apart from the red, are absorbed by the blood in the derma and warm this, the heat being circulated over the body.

While radiation treatment of wounds can be carried out by a mercury-vapour lamp in combination with a ring of incandescent lamps, one of the best methods of applying heat to painful parts is by a wax bath at 130° F. The melted wax solidifies at skin temperature and forms a glove on the submerged part of the body, which protects the skin from over-heating, the vapour of sweat under the glove acting as an insulator. The part becomes flushed with blood bathed in transuded fluid and raised in temperature. The whole body may be heated up a degree or two by immersion in the wax bath of the legs up to the knees. In chilblains, aching feet, and rheumatic pains the wax bath gives great relief. I call attention to the fact that a dark electric heater was not long ago put on the market, advertised very widely, and sold for ten guineas. The advertisement claimed that this heater gave off curative rays of a wave-length which corresponds to rays coming from objects colder than the body. The claim for the penetrating power of rays from this heater was based on the fact that after half-an-hour's irradiation there was some evidence of heat having passed through a beef steak. There would, of course, be some conduction of heat from the warmed surface. Such a source is no better than an ordinary electric bowl heater which can be purchased at a store for, say, fifteen shillings. Electric heaters placed on silver-plated stands and made of impressive shape are sold for many guineas for treatment purposes, when an ordinary electric fire or gas fire gives just as good results. At my suggestion an infra-red source, of an effective and economical pattern, has been made to run on gas. There is a disc made of a radiating material which gives off a fair percentage of short infra-rays heated to incandescence by a bunsen flame; the rays are concentrated by a concave metal reflector. The rays from such a source can be kept on as long as the patient likes, the intensity, of course, being such as not to

burn him. For inflammatory conditions such prolonged irradiation is of great value.

ULTRA-SHORT WAVES

Beyond the infra-red rays are these long wave-lengths which are used in wireless. The invention of the short-wave vacuum tube oscillator has allowed us to study what are called "ultra-short" waves, but it is not possible as yet to generate any intensity of wave-lengths less than one meter. The "ultra-short wave" instrument giving a wave-length of six metres puts the living tissues placed in the field between condenser plates into electrical stress, the electrons of atoms being driven first one way and then the other. This results in heating of the tissues. Artificial fever can be produced by putting the whole body, with the exclusion of the head, in the field; the temperature can be raised even to 105-106° F. in an hour or so. Great care has to be taken of the patient. Gonoccocal infection is thus destroyed, while general paralysis of the insane can be treated successfully by this method in place of the induction of malarial fever. Local heating can be produced by placing the electrodes (not touching) on either side, e.g., of the face, and the temperature of the mouth and nose raised thereby to 101-102° F. in some 20 minutes. Similarly, the rectum, and the urine in the bladder, may be heated by placing the electrodes on either side of the hips. This shows how the heating effect penetrates through the body in contrast to other sources of radiant heat, including diathermic ones with longer wave-lengths such as 300-400 metres, which penetrate only a little distance and heat deeper parts, if at all, merely by conduction. The "ultra-short" wave machine affords a new and most valuable method of treating all kinds of inflammation, for example, sinusitis, tonsillitis, appendicitis, pneumonia and pleural infection, carbuncles, and inflamed wounds, etc. There is no evidence of any specific effect as has been claimed, apart from that of heat. Dr. H. J. Taylor and I have shown that infusoria, the living heart, ciliated cells and muscle-nerve preparations of the frog when put in the "ultra-short" wave field suffer no change so long as they are kept cold. When allowed to be heated by the field they become affected just as they are by a rising temperature brought about by any ordinary means of heating. Claims are made that an apparatus giving an "ultra-short" field too weak to have any heating effect, exerts a beneficial effect on patients. The power of suggestion must be taken into account. Almost any new form of treatment will relieve asthmatics for a time. The psychological effect of suggestion is the main stock-in-trade of quack remedies.

ULTRA-VIOLET IRRADIATION IN SKIN DISEASES

By AUSTIN FURNISS, L.R.C.P., L.R.C.S., L.D.S., D.P.H.

(*Concluded from page 265, ante*)

Seborrhoea

Nagelschmidt states that he has treated a number of cases of seborrhœa—not accompanied by alopecia—and found that one or two mild irradiations cleared the condition up permanently. O'Donovan mentions the severe forms in which the whole scalp is affected; he recommends X-ray epilation as a primary measure for these, before the actinic radiation. It is advisable to give the scalp a spirit shampoo before irradiation. Long hair will require thorough combing during irradiation to ensure exposure of the scalp. Sulphur ointment may be applied between exposures. Seborrhœic dermatitis and infiltrated patches may require more severe reactions—second to third degree erythema—if plaques are associated with the papular dermatitis.

Herpes

This disease in its various forms responds well to ultra-violet irradiation. Relief is afforded not only from the severity of the eruption but from the accompanying pain

In fact, if seen early enough, little or no pain is experienced after the first treatment.

Vigorous local irradiation (second degree erythema doses) not only stop the immediate discomfort but prevent scarring. After each irradiation collodion may be employed with advantage as a dressing.

Post-herpetic neuralgia is not a usual sequel in cases treated by actinotherapy. This painful condition has been successfully treated by luminous heat irradiation with the Sollux lamp.

Technique. If the blebs are very irritable, the Sollux lamp should be used with a red filter, for its drying effect, before applying ultra-violet rays. The time of application is 15 to 30 minutes, at 20 inches distance. The mercury-vapour lamp is employed for local irradiation of the lesion, a heavy second degree erythema being obtained. Treatment is repeated daily until vesicles disappear. The Kromayer lamp in contact may be used to produce second to third degree erythema, on all vesicles. Treatment is repeated at 1 to 2 days' interval until irritation disappears.

Pernio (Chilblains)

The cure of this disease by ultra-violet irradiation is rapid and usually lasting, at least for the particular season, and if signs of recurrence show themselves the next winter another short course of light can be given. The worse the condition, the more striking are the results. There is usually an underlying systemic condition, for which general actinotherapy combined with calcium lactate is valuable (or with thyroid gland and iodine in the fat phlegmatic type of female patient). Under local irradiation the irritation is rapidly soothed and the fingers or toes resume their normal appearance. The severe itching subsides at the first or second irradiation. Results are lasting.

Technique. The mercury-vapour or the Kromayer lamp is used for local irradiation of the lesion. A second degree erythema is obtained. On subsidence of this, the treatment is repeated. Three to six treatments are usually sufficient. General body baths and concomitant calcium therapy may also be used as indicated.

Urticaria

This disease is probably associated with a decrease in the blood calcium. Mild applications of actinic rays usually suffice to relieve the intense itching and to clear up the condition.

Technique. General light baths with the mercury-vapour lamp are given to produce a first degree erythema reaction (or second degree locally on the affected area), combined with first degree general exposure. Treatment is repeated every second day, six to eight times in all. Calcium given in the form of the double salt, calcium sodium lactate, together with the ultra-violet irradiation is advisable.

Dermatitis Venenata

This condition responds satisfactorily to ultra-violet irradiation. After one or two doses the stinging is dispelled and spreading is usually prevented. Treatment is given every other day, using the air-cooled lamp, a second degree erythema being produced. Other examples of this condition respond well to ultra-violet light.

INFECTIVE INFLAMMATORY LESIONS OF THE CORIUM

Furunculosis

Boils, carbuncles, whitlows, septic corns, cuts, and pyodermia in children seldom fail to respond to properly-administered ultra-violet light applications. The local action on the lesion is bactericidal as regards surface organisms. There is an increased blood supply to the part, with an augmentation of lymphocytes and phagocytes. With

regard to the type of lamp to be used, some workers prefer the tungsten arc, others the mercury-vapour lamp. Heavy doses of the rays cause healing at a very much more rapid rate than by any other known method. If the case is seen early, one third degree erythema treatment will usually abort the pathological process. If pus has formed, the focus should be incised and evacuated, following this with erythema reaction. The result is speedy resolution, and relief of pain takes place within a few hours, with practical cessation within two days. Also irradiation of the surrounding skin destroys any staphylococci which have found lodgment in adjacent follicles.

Technique. Using the Kromayer lamp, an area 3 to 4 inches in diameter with the lesion in the centre should be irradiated to produce a heavy third degree erythema. The surrounding skin should not be covered. Treatment may be repeated in 2 to 3 days if necessary. General irradiation with the mercury-vapour lamp and other measures to increase lowered general resistance should be employed. The Sollux lamp should be used after incision, employing localizer and red filter for deep penetration. Ffteen to thirty minutes' irradiation of the lesion is given to alleviate pain and effect thorough drainage. This is followed by mild irradiation locally with the mercury-vapour lamp to accelerate healing. Vaccines are indicated in many cases, and undoubtedly act better when used in conjunction with ultra-violet light.

Erysipelas

Having dealt with this subject in great detail elsewhere it will only be briefly referred to here. The effects of actinotherapy in this disease are specific. A critical fall in temperature sets in within 24 to 48 hours, and the condition clears up quickly. Relapses are rare, and clear up equally readily on subsequent irradiation.

Technique. Any greasy ointment is removed. Using the Kromayer lamp at 2 inches distance, the whole of the affected area, including 1½ inches of healthy skin at the margins, is irradiated to produce a heavy third degree reaction. Only the eyeballs need protection in head cases. The Kromayer lamp is undoubtedly best for small areas. For larger areas, the mercury-vapour lamp should be used, covering the healthy skin almost to the margins of the area. One treatment usually suffices, unless part of the area has been under-irradiated. The area should be left uncovered after the irradiation.

Lupus Erythematosus

This condition responds well to ultra-violet irradiation, although at the outset it must be mentioned that there have been many contradictory opinions on the value of actinotherapy. Finsen, who first used light in the treatment of this disease, cured 14 cases out of 44 treated with the Finsen lamp, and improved 15. Sequeira considers that the "Finsen light treatment is of value in a small proportion of the chronic cases, but undoubtedly may increase the area of eruption in the more acute type." For this reason ultra-violet irradiation should never be employed where dissemination is occurring. Local treatment may be given with the tungsten arc or the Kromayer lamp. With the former the commencing dose is two minutes at eight inches, gradually increasing up to eight or ten minutes; the treatment is given twice weekly and reduced to once weekly as soon as definite response is noted. With the latter lamp compression is used, the commencing dose being five minutes. General treatment of the whole body by the mercury-vapour lamp is of great value, but not more than a dozen treatments should be given without the usual month's interval. Recovery is gradual in this disease, and the treatment must be continued for many weeks or months.

SKIN DISEASES ACCOMPANIED BY IRREGULARITIES OF SENSATION

Pruritus

The first thing to be done here is to discover any ascertainable cause, as the condition can be a symptom of a large number of different disorders. Pruritus occurs in uterine disease, pregnancy, hepatic cirrhosis, jaundice, chronic dyspepsia, diabetes, certain blood conditions, and nervous diseases. Pediculi, threadworms and scabies should be searched for, and the urine examined for albumin, sugar, bile and hyperacidity. In pruritus vulvæ, vaginitis should be sought for, and in pruritus ani, one should look for hæmorrhoids, fissure and sinuses. If no definite cause can be found, ultra-violet irradiation will give a good deal of relief from the intense itching. In fact, actinotherapy offers to the dermatologist one of the most valuable adjuvants in treating these conditions. It allays the hyperæsthesia and the irritation, and has a definite curative influence. Moreover, it is incapable of producing any harmful effects. As in many skin diseases, benefit is obtained if general irradiation be added to the local treatment. With general treatment the dose varies according to the patient's general condition. Concomitant therapy must always be adopted for the underlying causes (colitis, infection, leucorrhœa, etc.). The relief afforded by the irradiation is due to the analgesic effect of the rays on the inter-epithelial nerve fibrils, and also to a powerful bactericidal action. Ultra-violet irradiation is less dangerous than X-rays in the treatment of pruritus ani, but pruritus vulvæ, if there is any associated vaginitis, should be treated by diathermy.

Technique. The patient should be carefully prepared by cleansing the parts of crusts, removing hair, etc. The patient should be warned that the resulting erythema may be severe, and advised to rest in bed for several days. The Kromayer lamp is applied in contact, or at a few inches distance, and a third degree erythema dose is given. The intervals usually employed are 4, 3, 3, 4, 7, then 7 days; six to twelve treatments are usually sufficient for permanent relief.

NEW GROWTHS

Cicatricial Contractions and Scars

Ultra-violet irradiation gives good results in the treatment of simple hypertrophic scars. The scars in lupus patients have improved when a Kromayer lamp fitted with a blue " Uviol " filter has been used.

Keloid Scars

This condition will undoubtedly respond to ultra-violet light treatment. Authorities vary in their methods of treatment. Kromayer advised strong doses of half-an-hour with the blue " Uviol " filter. Other workers employ ultra-violet irradiation conjointly with radium or X-rays. The focalized tungsten arc, in a dosage of 2 to 6 minutes, used twice weekly has given good results. The usual procedure with the Kromayer lamp is to employ the blue filter as stated, applying firm compression, fourth degree erythema, repeated after sloughing has occurred.

Pigmented Naevi

Blister doses (fourth degree erythema) sometimes cause these blemishes to disappear. The skin around the affected part should be protected by adhesive plaster, and the Kromayer lamp with compression used. Sometimes one dose is sufficient, but generally two or three are required. The second exposure should not be repeated until the reaction from the first has settled down.

Port-Wine Stain

For this condition the Kromayer lamp with a compressor is used, the exposure lasting from five to twenty minutes. If the lesion is small it may be treated at one sitting. If large, the external portions are first treated and then the area is gradually lessened by succeeding treatments. About a fortnight should be allowed to elapse before any area is again irradiated. The condition is very difficult to treat. Many other forms of treatment have been used, such as carbon-dioxide snow, radium, X-rays and electrolysis. Kromayer reported good results from the use of his lamp with the blue filter under compression. In 1932 he wrote that "he had treated 1,500 patients with radium, and many thousands with X-rays, and had had very few and very mild deleterious effects." He never gave X-rays more than three times in one year. There is, however, no fear whatever of doing harm with light irradiation.

Ulcers

Whether an ulcer is due primarily to a certain organism or to trauma, secondary infection with the usual pyogenic germs is always present. This septic material has to be removed before any healing can take place. In most chronic ulcers defective circulation and consequent poor nutrition are to be found in the surrounding tissues. Furthermore, the missing epithelial surface of the ulcer must be regenerated.

Ulcers respond well to ultra-violet irradiation, the rays producing a direct bactericidal action on the surface organisms, relief of pain, stimulation of the local circulation, growth of healthy scar tissue, and increase of the calcium content of the blood. The cyanosed appearance frequently associated with varicose ulcer turns, after irradiation, to a much healthier tint.

Technique. Two stages in the treatment will be described:

Stage 1. Here there must be destruction of infection, stimulation of tissue, and restoration of local nutrition. The ulcer is cleansed with hydrogen peroxide. Then the Sollux lamp, with localizer, is applied for 15 to 20 minutes at a short distance, followed by the Kromayer lamp at a short distance, the dosage being suited to the condition of the lesion. A moderately septic ulcer may require 20 times, and a very septic ulcer with sloughing edges to possibly 100 times, the erythema dose. The treatment is repeated 2 to 3 times, at 2 to 3 day intervals, until a healthy condition is established and new granulations appear.

Stage 2. Mild stimulation of new granulating tissue in a clean wound until regeneration is complete. Mild irradiation is now given, e.g., the Kromayer lamp with blue filter (or the mercury-vapour lamp at 40 inches) in sub-erythema doses to the ulcer surface and surrounding skin. The Sollux lamp with localizer is used to promote mild hyperæmia in the affected area; this is given before the ultra-violet irradiation to promote local circulation and assist the actinic reaction. Treatment is repeated at 2 to 3 day intervals, until regeneration is complete. If the rate of healing slackens, a slight increase of dosage is indicated. The mercury-vapour lamp is used for general light baths to supplement the local light treatment; this is essential in tuberculous ulcers. Sub- to first-degree erythema doses are usually indicated; excessive stimulation must be avoided if there are any signs of thrombo-phlebitis.

Indolent Wounds

Ultra-violet irradiation is a powerful factor in the healing of wounds. The direct bactericidal action of short-waved rays, combined with the leucocytosis which they produce, quickly overcomes infection, and brings the lesion to a condition in which the stimulus of milder irradiation promotes strong free proliferation of new tissue. Wounds treated in this way heal rapidly with excellent cosmetic results, leaving scars of smooth, fine texture, usually level with the skin.

Technique. The wound is first cleansed with hydrogen peroxide, alcohol, or ether. Any flaps are detached. If inflammation is present luminous heat rays, using the localizer, are employed to produce deep hyperæmia around the lesion. The Kromayer lamp is then used at close distance, giving a third degree erythema dose on the surface to produce increased flow of serum, extrusion of pus, dead tissue, etc. The wound is covered after the treatment. For deep punctured wounds, irradiation is given through an applicator dipping into fluorescent dye. This powerful dose must only be repeated if infection persists after 2 to 3 days. As soon as the wound is clean and new granulation tissue appears, mild irradiation (mercury-vapour lamp at 40 inches or the Kromayer lamp, with blue filter) is given. First degree erythema is produced with local doses, daily or every second day.

General light baths with the mercury-vapour lamp should be given. Aseptic operation wounds may also be treated by giving mild irradiations with the Kromayer lamp, using the blue filter, or the mercury-vapour lamp at 40 inches distance; first degree erythema doses are given daily, when dressings are changed.

Tuberculous Skin Lesions

I have dealt at length with these conditions in the medical journals, so they will only be briefly dealt with here. In treating lupus vulgaris the best results are obtained by treating the disease as a local manifestation of a general tuberculous infection; both local and general actinotherapy are indicated. At the London Hospital this procedure has increased the percentage of cures from 60 to 90, and O'Donovan stated that "early lupus is always curable." The granular tissue surrounding the nodules is dissolved by repeated irradiation until the nodules lie in new scar tissue and are resorbed under the action of light. Treatment may have to be carried out for many months, and patients should be examined after six months, to guard against relapse.

Technique. The Kromayer lamp is used with the skin lens (or window), with firm compression; fourth degree erythema is given to each focus and ⅛ inch zone of surrounding skin. The reaction is alleviated by cold boracic compresses; treatment is repeated on complete subsidence. For lesions in the mouth, throat and nose the same procedure is employed, with suitable applicators. Both the immediate reactions and the final results are greatly improved if local hyperæmia is produced in the diseased tissues before application of the Kromayer lamp. The Sollux lamp with localizer will give valuable help in this regard.

If the lesions are heavily fibrosed through previous maltreatment, softening measures (e.g., salicylic acid and creosote plaster, electrodesiccation, luminous heat, etc.) may be necessary before the erythema reaction can be obtained. Some authorities advise X-rays for this purpose; others regard them as likely to cause malignant disease later. For general treatment the mercury-vapour lamp is used (combined with the Sollux lamp), giving first degree erythema, repeated on subsidence. It is interesting to note that lupus patients may require exposures 50 per cent. greater than normal.

In tuberculosis verrucosa good results are obtained from a combination of local and general actinotherapy. For general treatment, irradiation on tonic lines is given, precautions being taken if the condition is associated with pulmonary tuberculosis. Using this lamp a second degree erythema can be given to cover the entire diseased area. If the Kromayer lamp is used, the blue window should be employed, a third degree erythema dose being given (i.e., 5 minutes contact) to any densely infiltrated lesions. On subsidence of erythema, treatment should be repeated.

Erythema Induratum (Bazin's)

The results reported refer to cases of the tuberculous type of erythema induratum (Bazin), which occurs in young women, usually on the leg. E. L. Oliver reported

five cases, all successfully treated.

Technique. The Kromayer lamp is most satisfactory; it is applied with firm compression to the indurated areas, a fourth degree erythema dose being given. Two or three areas are treated at each session. One application to each area is usually effective.

Conclusion

From the above it will be seen that a great many skin lesions can be beneficially treated by means of ultra-violet irradiation. The effects of this irradiation on skin diseases are many and varied, and, according to the particular condition present, are brought into play by the advice of the actinotherapeutist. Many of these effects have been previously mentioned, but stress should be laid on the great value of general treatment along with the special form of local treatment adopted. It is to be hoped that greater use will be made of this mode of treatment by practitioners and specialists in the future.

ELECTRO-MEDICAL APPARATUS: ITS CHARACTER, OPERATION AND CARE:

PART II. No. 12 (continued)

By L. G. H. SARSFIELD, D.Sc., M.I.E.E., A.Inst.P.
Chief Engineer, Research Department, Woolwich.
Hon. Consulting Radiological Engineer to University College Hospital.

X-RAY TRANSFORMERS

THE high voltage necessary for energizing an X-ray tube is in most cases provided with the help of a transformer. In early X-ray work induction coils were used, but these have long since been superseded. Some of the pioneers in the radiological field used static electricity to energize their tubes. This was obtained from some form of frictional device such as the Wimshurst machine. It is interesting to note that one of the latest extra-high voltage X-ray installations built in America employs a form of frictional generator incorporating a moving belt which delivers electric charges to a large electrode, thus building up its potential to a high value.

It has been pointed out earlier that the main differences between the induction coil and the transformer are in the magnetic core and in the method of electric supply. The core of the coil is " open " while that of the transformer is " closed," i.e., affording a complete iron circuit for the magnetic field. A coil is supplied from direct current and relies upon an interrupter to produce current changes in the primary winding and consequent field changes which induce electro-motive forces in the secondary winding.

The transformer is supplied with alternating current. The alternating current in the primary winding produces in the core a magnetic field (or flux) which cuts the secondary winding, generating in it an E.M.F. proportional to the number of turns.

For X-ray purposes the voltage of the mains has to be transformed up, and therefore the number of secondary turns has to be greater than the number of primary turns.

The design of a transformer is a very specialized art, and a discussion of winding impedances, voltage drops, voltage and current-phase differences, magnetic field distribution, etc., would not be appropriate here.

The general equation for the root mean square (R.M.S.) value of induced E.M.F. in volts assuming a sine wave form is

$$E = \frac{2\pi f}{\sqrt{2}} \times \phi \times N \times 10^{-8}$$

where ϕ = total magnetic flux, lines, through the core
N = number of turns in the winding under consideration
f = wave frequency, cycles per second.

The chief problem confronting the designer of the X-ray transformer is one of insulation. The *continuous* power output of the X-ray transformer is small (instantaneous outputs are correspondingly large), and it is a constant aim of the designer to keep dimensions to a minimum but, opposing this aim, is the need for adequate insulation clearances to take care of the very high voltages involved. The insulation problem is simplified by immersing the transformer in oil which has high insulating strength. The iron core (generally constructed from thin laminations) is generally at earth potential and the insulation has to be such that there is no electrical breakdown from the high voltage windings to the core, the enclosing tank, or the primary winding. Since the primary winding is practically at earth potential it can be wound close to the core, whereas the secondary high-voltage winding has to be separated from the core and primary by insulation as shown in Fig. 179*a*.

In Fig. 179*a*, is shown an arrangement in which the insulation comprises a thick cylinder of solid material, A, upon which the secondary winding is assembled. With this arrangement, coils into which the winding is sub-divided must be separated from one another because of the potential difference which exists between them. One part

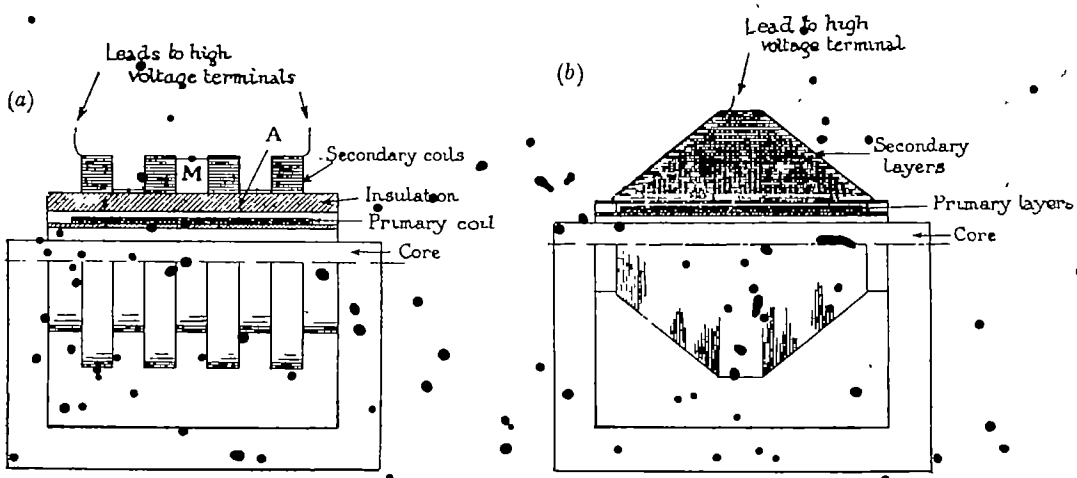


Fig. 179.—Diagram of X-ray transformer showing upper half of windings and insulation in section. The transformer tank is not shown. (a) The mid-point, M, of the secondary winding is earthed, and the ends are at high potential. (b) Diagram of X-ray transformer showing upper half of windings and insulation in section. One end of the secondary winding is at earth potential and the other at high potential. The transformer tank is not shown.

of the secondary high-voltage winding is generally earthed. In the case of Fig. 179*a*, the centre point M would be earthed, while the right-hand and left-hand extremities would be at high potential. Those two ends of the winding would be taken out of the tank in which the transformer was oil-immersed by way of suitable insulating bushings carrying terminals.

Another form of secondary winding is shown in Fig. 179*b*. In this case one end of the secondary winding is earthed, and therefore only a thin layer of insulation is necessary to separate it from the primary winding. The secondary winding comprises a number of layers of wire of successively increasing diameter and decreasing length. As the number of turns increases, the layers get farther and farther from the core, and so, as there are thin layers of paper between layers of winding, the total insulation grows as the voltage grows.

Fig. 180 shows the interior of an X-ray transformer. Each manufacturer has his own design, but the aim is always to produce a transformer as small, reliable, efficient and safe as possible. The ends of the high voltage winding of the X-ray transformer have to be connected to the X-ray tube and, whereas in early apparatus the connections were bare and dangerous, in modern plant the connecting leads are covered with insulation and the covering is overlaid with earthed metal; also the X-ray tube itself is sheathed in earthed metal so that no high-voltage point is accessible to cause accidental human contact.

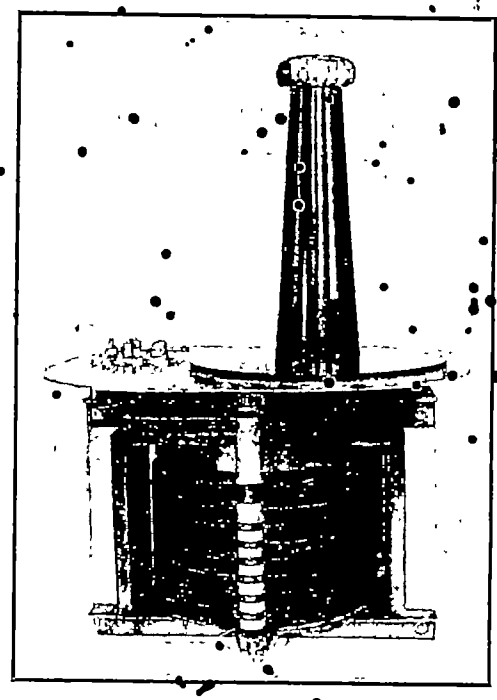


Fig. 180.—Interior of X-ray transformer showing a vertical stack of coils assembled on the middle leg of the iron core. The tank lid is assembled on the core and carries the insulating bushing for conveying the high voltage out of the tank in which the core and windings are oil-immersed.

There are many special forms of both magnetic core and winding devised for reduction of transformer dimensions. An interesting example is given in Fig. 181,

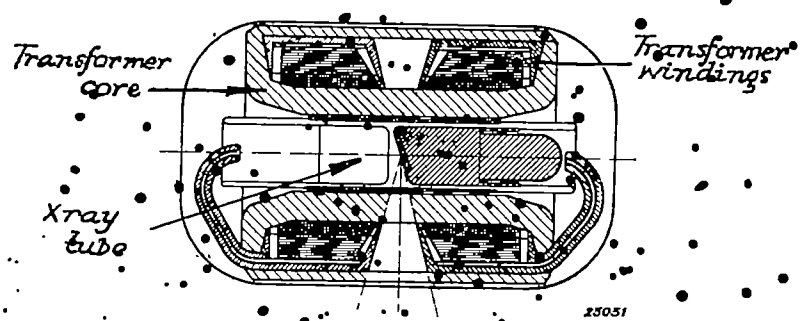


Fig. 181.—Sectional diagram showing internal arrangement of Philips "Centralix" X-ray apparatus. The tube is in the central horizontal space, and the transformer surrounds it.

which shows a section of the Philips "Centralix" transformer and tube assembly. The transformer core entirely encloses the windings and a central cylindrical space encloses a tiny X-ray tube. A suitable hole permits the emergence of the X-rays. The enclosure of the windings prevents any external electric field and effects a shock-proof design; moreover, the windings are designed for the elimination of corona.* There is no waste of space so that dimensions and weight are at a minimum.

RECTIFICATION

An X-ray tube behaves like a valve when its anode target is maintained at a low temperature. It permits current to pass one way only. This quality is, however, not

*A bluish, brush-like electric discharge accompanying intense field concentration.

perfect, as we shall see in the following lines. The electrons from the heated filament are shot over to the target when the latter is at positive potential with respect to the former, but, when the polarity is reversed, the electrons from the filament are not drawn over to the target and so current flow is arrested.

In some X-ray plants, particularly those of small power, the X-ray transformer is connected direct to the tube as shown in Fig. 182. In larger apparatus, however, the rectifier is connected between the X-ray transformer and the tube since it cannot be ensured that the target, though having a general temperature which is low, may not have, somewhere or other, a hot spot capable of releasing electrons which could be shot over to the filament when the polarity is favourable. Such current flow in the direction opposite to normal would soon cause damage to the filament which is not designed to withstand bombardment, and consequently such bombardment must be prevented. A rectifier or a rectifying system incorporating one or more rectifying units is therefore necessary.

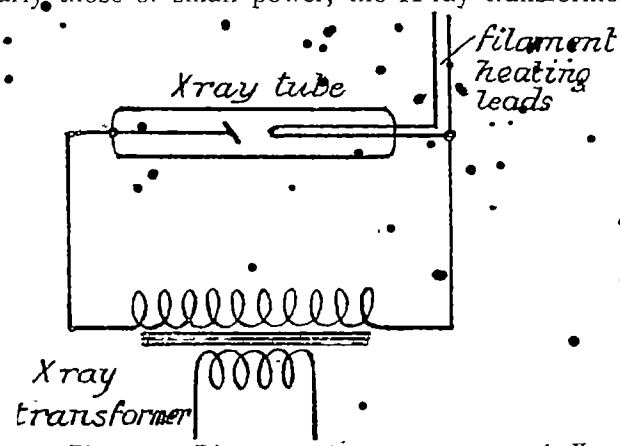


Fig. 182.—Diagrammatic representation of X-ray transformer connected direct to an X-ray tube (i.e., without rectifier).

Mechanical Rectification

Except in a few cases of experimental plant, mechanical rectifiers are not used to-day, but a few words will be devoted to describing their function and characteristics. The mechanical rectifier is in fact a high-voltage switch connected in the X-ray tube circuit and rotated in synchronism with the alternating current supply.

Many forms of mechanical rectifiers were used. Two examples are shown in Fig. 183 and; in (*a*) is shown a cross-arm rectifier with an insulating horizontal shaft

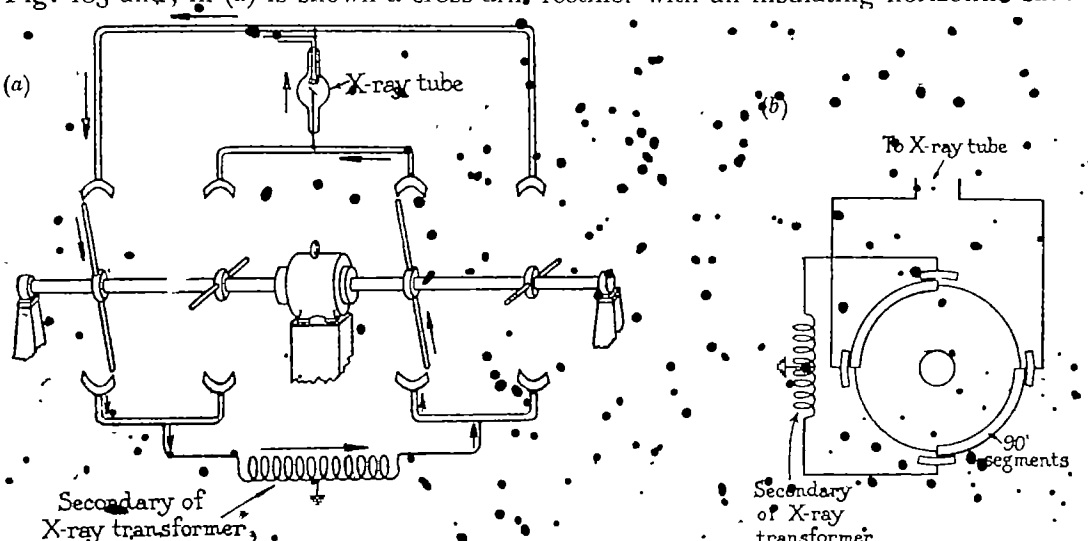


Fig. 183 (a) Diagram of a cross-arm rectifier. The cross-arm shaft rotates synchronously with the alternations of the current through the X-ray transformer. (b) Diagram of a disc-type mechanical rectifier.

revolved by the central motor. The four cross-arms permit the X-ray tube to be connected to the X-ray transformer twice during every revolution. When the cross-arms are in the position shown, current flows as indicated by the arrows by way of the first and third arms (counting from left). During the next half cycle, when the current is flowing the opposite way in the transformer, the position of the cross-arms is such that the second and fourth are connected to the X-ray tube and therefore the current will flow still the same way through the X-ray tube. The speed of revolution of the shaft is 1,500 R.P.M. and corresponds to a frequency of 50 cycles per second of the current in the transformer.

The disc-type of mechanical rectifier is seen in Fig. 183a. In this case metal segments mounted on an insulating disc form the connecting links between the X-ray transformer and the X-ray tube.

In both these rectifiers the electric current flows by way of sparks as the moving electrodes pass the stationary ones. In some designs metal contact-brushes were used, but these brushes wore out very quickly. The air gaps employed in the non-contact type rectifiers used to be kept as small as possible so as to reduce to a minimum the loss of voltage caused by the sparks jumping across the gaps.

Mechanical rectifiers permit only a part of the wave of current to pass, the proportion depending upon the design of the device. The elimination of the lower voltage parts of the wave is not generally a disadvantage in X-ray work, since the low voltages excite only feebly penetrating radiation. This principle is in view in the design of certain X-ray tubes which transmit current only during the time when the voltage wave has a high value. This ensures that the current is passing at high voltage and therefore maximal penetration is secured.

Fig. 184 shows simple diagrams indicating theoretical conditions of current flow when rectification is taking place. The practical conditions are considerably different, however, but the principles of the phenomenon are well indicated by the diagrams.

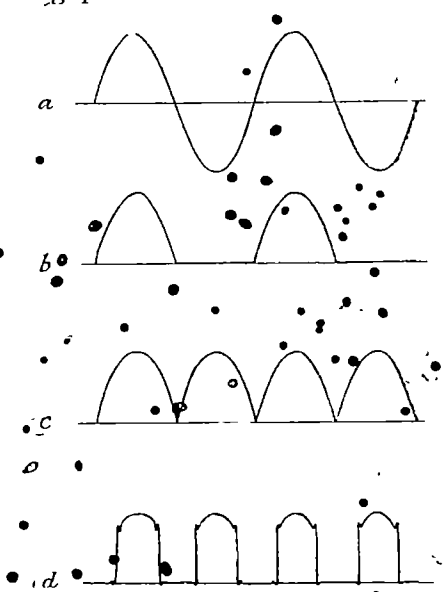


Fig. 184.—Diagram showing:—
(a) Alternating current wave.
(b) Half-wave rectification, as by valves (alternate half waves suppressed).
(c) Whole-wave rectification, as by valves.
(d) Chopped whole-wave rectification, as by mechanical rectifier.

With mechanical rectifiers it was not in general possible to apply a voltage greater than that of the transformer to the X-ray tube. With valve-type rectifiers one is able to make use of a number of voltage-multiplying circuits so that voltages greatly above that supplied by the transformer may be available for working the tube.

Some features and characteristics of valve rectifiers as used in radiology will be given in the next paper, and also some notes on the theory of voltage-multiplying circuits and how they are adapted to X-ray plant.

SOME PLAIN TRUTHS ABOUT FOOTGEAR

Dr. James Mennell devoted his presidential address before the Section of Physical Medicine at the Royal Society of Medicine, on 17th November, to the discussion of footgear. Before coming to that subject he made some remarks concerning his own introduction to physical therapy. When he looked back to the time of his own entrance into the profession and compared the present position of physical medicine with the position as he knew it then, he could only express profound thankfulness for what had been achieved. In the early years of the present century he made the acquaintance of what was now known as the Chartered Society of Massage and Medical Gymnastics. Its membership then was some 700; to-day it was 11,000 strong, and over 8,000 of its members were in service in the war. That growth alone was a good answer to pessimism.

Coming to the subject of footgear, Dr. Mennell first remarked on the ignorance which prevailed in the medical profession. He was once present at a meeting of medical men when this subject was under discussion, and a question proved that there was general ignorance as to what was meant by the term "size" as specifically used by shoemakers. A "size" is one-third of an inch in length. To send a patient to a bootmaker for a shoe without being able to specify the exact measurement required was rather like sending a man who had abdominal pain to a chemist with a request that he be given something soothing. Dr. Mennell had been told that the problem of clothing the feet of the evacuated children was proving to be far more difficult than that of clothing their bodies.

In the windows of the large shoe shops there would be found a division between the "gent's department" and the "ladies' and children's department." It was quite understandable to have a division between children and adults, but why should ladies and children be put together and ladies and gentlemen in contrast? Scientifically, the human foot had not one pattern for men and another for women. The only bone in the foot which could be distinguished anatomically as belonging to a male or a female was the astragalus, and to make even that distinction a micrometer screw was necessary. There should be no difference between the two sexes. If there was a difference it was because of slavish devotion to fashion. Usually in the ladies' department would be found relatively high heels and pointed toes, and in the men's department relatively low heels and square toes. There was no justification for this distinction.

With regard to the sole of the shoe, Dr. Mennell said that the contour of any shoe should be roughly triangular as seen from above, the angle of the heel being somewhat rounded. By putting a rule on a number of commercial shoes, he illustrated how varied they were in this respect. In a normal foot a straight line from heel to toe, running through the middle of the "waist," should pass through the space between the second and the middle toes, but many shoes were so designed that this line passed obliquely, so that there was a forcible strain on the joints of the fore part of the foot, tending to swing it away from the side which carried the pressure.

Another point was that it was necessary to allow two shoe "sizes" beyond the limit of the actual foot measure in order to accommodate the difference between the extension of the foot in resting and walking. What shape was taken by the front of the shoe beyond the limit of that essential space was a matter of indifference. It did not matter to what degree the toe was pointed provided that the shaping took place at the correct site. There was no quarrel between the human foot and the pointed toe provided that care was taken as to where the sloping towards the point began. The shoemaker often tended to slope too soon, with the result that on one side there was compression of the hallux and on the other side there was no room to accommodate the little toe.

On the vexed problem of the high heel, Dr. Mennell said that such a heel—certainly up to 2½ inches—was not of necessity to be condemned, whereas the low heel of ¼ inch to ½ inch on the men's side might be as harmful for some men as was the heel of 3 inches or more for some women. The sufficiency of the tendo Achillis alone should control this problem, and on this depended that of the flexor longus hallucis. There were many men who would never walk in comfort with less than a 2½-inch heel, and many women who also would never walk in comfort, apart from some very special form of footgear, unless they had a ½-inch heel or no heel at all. The low heel might be most

pernicious, even for a man. The condition known as "pseudo-intermittent claudication" arose from one cause only, the wearing of too low a heel. At the same time, he must not be taken as advocating the extravagantly high heel, and he could not honestly say that any human foot, unless extraordinarily abnormal, required a heel of more than 3 inches in height. He also criticized the custom of being measured for shoes while sitting in a shop chair. The fact was often ignored that when the weight of the body was put on the latter the foot would shoot forward for a "size" at least, perhaps for 1½ "sizes." The foot invariably spread out when pressure was placed upon it. If a tape-measure were put round the foot it would be found that the measurement increased on standing by about ½ inch, and it was not at all uncommon for the difference in measurement as between the standing and sitting posture to be ¾ inch.

Coming finally to the "upper," he warned that no reliance should be placed on the length measurements given on the boxes in ladies' departments. It was not uncommon for what proved to be 7 or 8 inches in length to be described as a "five." In the case of men's shoes there was less disparity in this respect. He also demonstrated, by means of a large number of shoes which he had accumulated, the enormous variety in shape of the uppers. It was customary to slope the front part of the shoe down gradually for a considerable distance, but, if this were done, it necessarily reduced the amount of room available in the forepart of the shoe, especially over the big toe. It was important to have depth under the toe-cap. Another necessity was to have some contrivance for keeping the heel of the foot back in the heel of the shoe. The position should be properly controlled by straps, laces, or other contrivances. If straps were used there should be two of them at least; one strap would not suffice. It was specially necessary in children to have a definite grip, so that the foot was prevented from slipping forward into the front of the shoe. The effect of such slip forward was just as bad as the wearing of a shoe that was too short. He demonstrated how the placing of a pad of felt underneath the tongue of the shoe might reduce materially the whole instep measurement and so enable walking to take place with freedom without the slipping forward of the foot into the front part of the shoe.

It was sometimes not appreciated that the two feet were often unequal in length, and it was difficult—though it could be done—to persuade boot shops to sell a pair of shoes of different sizes for each foot.

In his final words, Dr. Mennell paid an eloquent tribute to the marvels of the mechanism of the human foot. A painless foot ought to be the human heritage, but a very general fate—only too often testified by the thriving business of the chiropodists—was needless and avoidable suffering. This followed from the lack of co-operation between shoe manufacturers and the medical profession. The foolishness of people in submitting to the tyrannies of shoe fashion not only caused painful feet but was fatal to the maintenance of correct posture, and it was also a fruitful source of mental irritability.

A hearty vote of thanks to Dr. Mennell for his address was proposed by Dr. Fortescue Fox, who bore testimony to Dr. Mennell's highly original work in the past, which had had repercussions throughout the world of physical medicine.

It was announced that the foot is to be taken as the general theme of discussion at the Sectional meetings during the present session, and that the next meeting in January will be devoted to the abnormal foot.

CORRESPONDENCE

Letters are welcomed on all matters of general interest. Publication does not necessarily imply that the Editors agree with the views expressed.

To the Editor,
The British Journal of Physical Medicine.

Ultra-Violet Irradiation in Skin Diseases

Sir,—As a dermatologist I feel that I cannot allow Dr. Furniss's paper, published at page 259, *ante*, on *Ultra-Violet Irradiation in Skin Diseases*, to pass without comment. Like many people, Dr. Furniss claims numerous successes with this treatment of skin diseases in which ordinary remedies would give as good results if properly used.

In impetigo contagiosa, for example, Dr. Furniss claims that ultra-violet irradiation will clear up the condition in a week or ten days, and he states that a strong reaction is required. Treatment with ordinary ointment, or rather paste, will clear up this condition in a week, if properly applied. Is it justifiable to put the patient to the expense of a fancy remedy and all the considerable discomfort which a third degree erythema entails, when the disease will not be cleared up a day earlier?

Pityriasis is only a sign and not a disease, s. Dr. Furniss seems to suggest. The word neans, scaliness and nothing else, and must ave an adjective before a disease is indicated. hus we have pityriasis capitis, pityriasis rosea, ityriasis rubra, pityriasis rubra pilaris, pityriasis chenoides chronica, to mention the names of nly a few conditions in which this word occurs. Which does Dr. Furniss mean? If he means ityriasis capitis, I would quote Kromayer gainst him. Kromayer states that he has arried out exhaustive tests for 25 years, and hat his results have been unsatisfactory; he siders that the beneficial results claimed have een in cases of symptomatic alopecia or of lopecia areata.

Alopecia merely means baldness, and there re many types. Dr. Furniss shows little nowledge of the disease called alopecia areata. he two types of alopecia which he mentions re merely the one disease alopecia areata, hich is sometimes limited to patchy baldness n the scalp and at other times affects the whole ody, when it is known as alopecia areata talis.

As tinea corporis ordinarily clears up in a ortnight under proper treatment, why use ltra-violet rays and produce so much discom- ort by giving strenuous reactions? Too many ases of tinea capitis have been found to be ctive after intensive ultra-violet ray treatment or this remedy to be applied or advised by ermatologists. When X-ray treatment is pro- erly administered the risk of baldness is very ight.

Xeroderma and ichthyosis are merely different egrees of the same condition, and cannot be ured by the method suggested in Dr. Furniss's aper. Admitting that thyroid extract is useful nd that the rays may stimulate that gland, here is more in the condition than that. The kin is deficient in fat, and the condition lasts s long as the patient lives. Grease must be pplied regularly to the skin to keep the patient comfort. Does Dr. Furniss advise light eatment regularly for the rest of the patient's fe? Even if he did, grease would have to be pplied, and no strong inflammatory reaction necessary with the grease treatment.

X-ray ulcers have been satisfactorily treated ith an ointment containing Vitamins A and ; and again I would ask if it is justifiable to ut the patient to the expense of a fancy emedy when ordinary treatment will do all hat is desired.

Yours sincerely,

ROBERT AITKEN.

Edinburgh, December, 1939.

CONTEMPORARY PHYSICAL MEDICINE

ABSTRACTS

Sulphanilamide and Skin Photosensitivity

Photosensitization of the skin, though theoretically possible with large doses of sulphanilamide, is a rare occurrence. The condition should, however, be borne in mind, as the modern tendency is to give large doses of the drug, and this tendency may result in an increase in the incidence of this interesting phenomenon. W. V. Wax (*New York State J. Med.*, 1939, 39, 723) reports a case in which delayed photosensitivity occurred, that is it appeared a few months after discontinuation of sulphanilamide therapy. The secondary factor which provoked the erythema was exposure to sunlight, both natural and artificial, over a prolonged period. The sensitized areas consisted of large deep patches, brown in colour, having characteristic sharply defined borders. These areas were seen to break down and to produce ulcerations. The author warns against exposure to sunlight during sulphanilamide therapy, as this might induce in specially sensitive skins these reactions, the treatment of which can prove extremely difficult.

Cryotherapy in Cancer

Fay and Henry in *Surgery, Gynæcology, and Obstetrics*, February, 1939, reported on the use of cryotherapy in the management of malignant tumours. Cryotherapy, or the application of certain levels of temperature below the bodily norm, has certain physiological effects which can be utilized in the fight against disease. When a human body is placed in a colder environment it loses part of its heat. On keeping it in this environment this antipyretic action gives way to stimulation, during which the blood vessels are contracted and metabolism is lowered. Local and general malnutrition follow after prolongation of exposure, and finally local gangrene and somatic death ensue. Between the extremes the body can adapt itself to attain a stage of lethargic action even to the point of hibernation. This may, in the future, provide a revolutionary form of anæsthesia, superseding all previous methods of inhalation, injection, etc. Cold depresses the biological and pathological activities of the cell. This fact led research workers, such as Fay, Temple and Henry (*Arch. Phys. Ther.*, 1939, 20, 511) to the study of its effect on carcinomatous cells. They succeeded in reducing pain, raised the nutritional state, and attained a fall of 29 per cent

in the basal metabolic rate by inducing hibernation through irradiating the pituitary, thyroid and ovarian glands.

The possibilities of this field are too far-reaching to say more about it at this stage. Hibernation may well be a definite therapeutic agent in years to come.

THE SOCIETY OF PHYSIOTHERAPISTS

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Society of Physiotherapists will be held on February 3rd, 1940, at 2.30 p.m., at the Langham Hotel, London. Formal notice of the meeting with agenda will be forwarded to members early in the New Year. The Committee hopes that members will endeavour to attend the meeting and help in the discussion of the various matters dealt with during the year as well as the future work of the Society. Following the meeting, tea will be served, to which members are asked to invite a physiotherapist colleague if possible.

THE NOVEMBER SUPPLEMENT.

The Committee has been very pleased to receive several letters of congratulation concerning the contents of the *November Supplement*, and wish to take this opportunity of thanking those members who were good enough to write and express their appreciation and give their several points of view.

MEMBERSHIP OF THE SOCIETY.

The Executive Committee would like once again to state that membership of the Society of Physiotherapists is limited to medical auxiliary physiotherapists, i.e., those physiotherapists qualified for registration by the Board of Registration of Medical Auxiliary Services. Some enquiries have been received recently concerning this point, and the Committee thinks it may be worth while to remind members of the scope of the Society's membership.

CHRISTMAS AND NEW YEAR WISHES.

The Committee wishes to convey to all members of the Society their good wishes for Christmas and the New Year. Although the past months have been worrying and trying for the majority of us, we feel that the New Year will bring a gradual return to more normal conditions—already there is some indication of this—with the resulting more normal demand for members' services.

REVIEWS OF BOOKS

Massage

Massage and Remedial Exercises. By Noel M. Tidy, C.S.M.M.G. 458 pp., 178 illus. Price 15s. Bristol, 1939: John Wright & Sons.

The fact that a fourth edition of this book appears within seven years of the first is an indication both of the popularity and of the intrinsic merit of the work. For those who are not familiar with previous editions it may be recalled that the work is primarily designed for students or qualified members of the Chartered Society of Massage and Medical Gymnastics. At the same time it is so full of practical information, presented in such a clear and concise form, that it makes a worthy and eminently useful addition to the bookshelf of the medical practitioner who is interested in the subject of massage and remedial exercises.

This book deals with the physical treatment of every condition in which such treatment can be of service; to complete the clinical picture, much useful information is given concerning the ætiology, morbid anatomy, symptomatology, etc., of the conditions dealt with, and general medical and surgical measures are indicated.

In this edition new sections have been added on myositis ossificans and on the effects of poison gases, with suggestions concerning treatment. A noteworthy feature is that additional information has been given on such important forms of electrotherapy as diathermy, short-wave therapy, and ultra-violet and infra-red irradiation, since these are so often employed with advantage in association with massage and exercises.

The book is arranged in a clear and sensible fashion, which should be a great help to the student. The illustrations also are noteworthy in that most of them are reproduced from moving pictures taken of actual exercises.

A.C.

OBITUARY

DEATH OF DR. OSCAR BERNHARD.

It is with the greatest regret that we have to announce the death of Dr. Oscar Bernhard, which occurred on the 14th November, at St. Moritz, after a long and painful illness. Dr. Bernhard was in his seventy-eighth year.